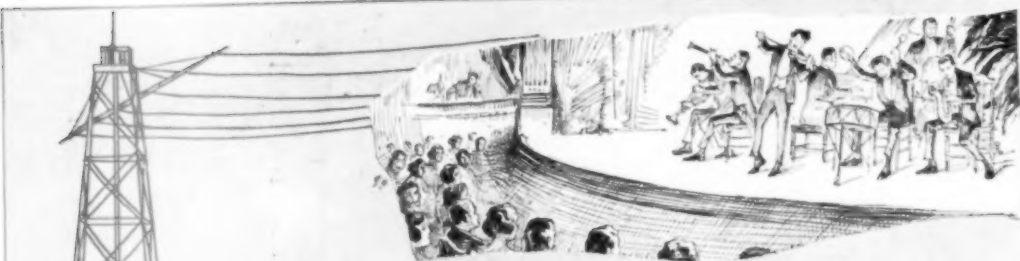


QST

Published by the
AMERICAN RADIO RELAY LEAGUE
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AMATEUR RADIO





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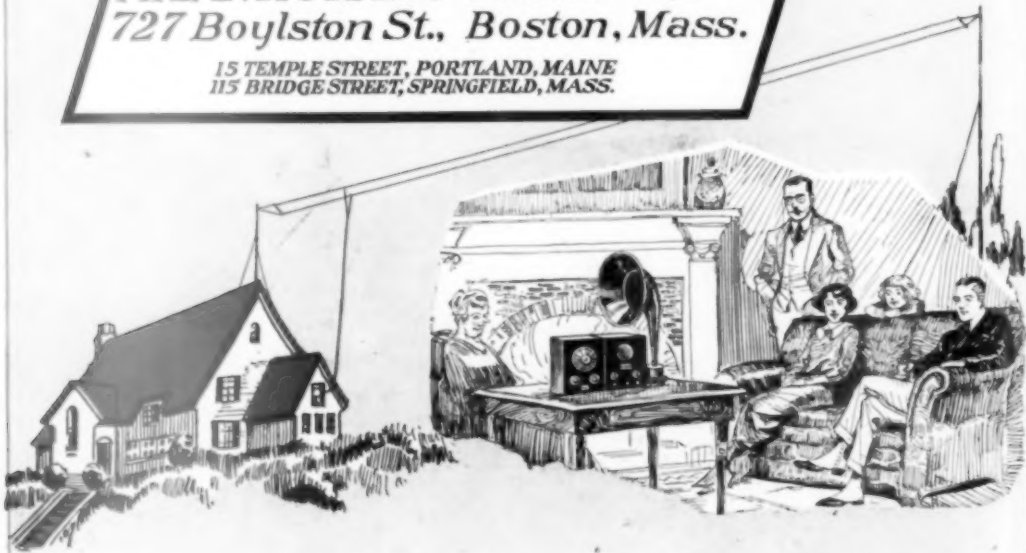
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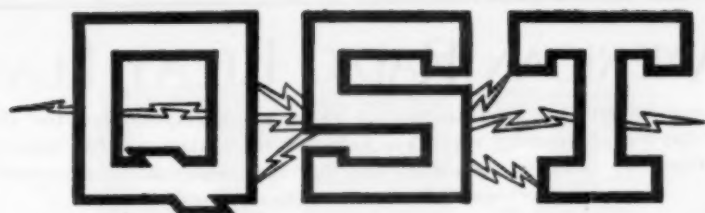
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The Official Organ of the A.R.R.L.

VOLUME V. ✓

MAY, 1922 ✓

No. 10 ✓

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QST is published monthly by The American Radio Relay League, Inc., at Hartford, Conn. Kenneth B. Warner (Secretary, A.R.R.L.), Editor and Business Manager.
Edwin C. Adams, Advertising Manager.

Subscription price in United States, Possessions, and Canada, \$2.00 per year.
Foreign, \$2.50. Single Copies, 20 cents.

Entered as second-class matter May 29, 1919, at the post office of Hartford, Connecticut, under the Act of March 3, 1879.

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HARTFORD, CONN.

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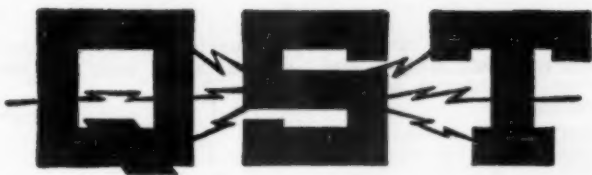
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A Magazine Devoted Exclusively to the Radio Amateur

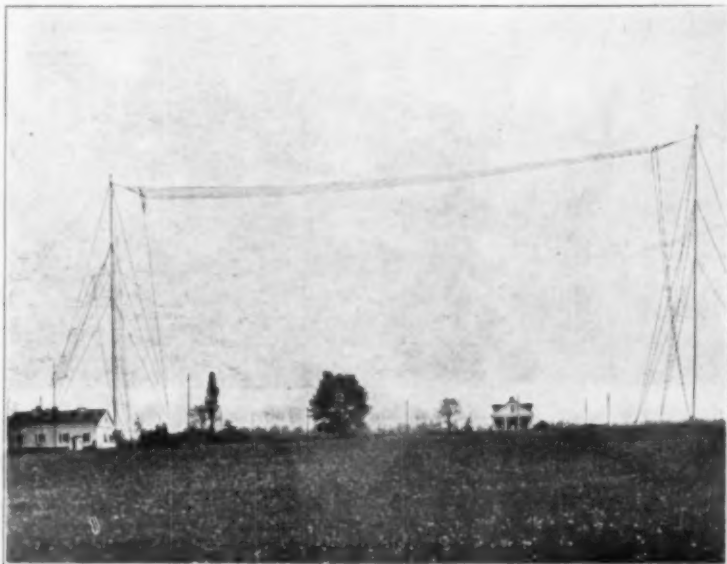
3ZO---An Amateur Paradise

RADIATES there a ham with soul so dead who never to himself hath said—"Gee, if only I had the jack wouldn't I have a bird of a station!"

Such a station is that of Mr. Horace A. Beale, Jr., of Parkesburg, Pa., a director in our A.R.R.L. In fact Mr. Beale has three of them, 3ZO, 3XW and 3OI. This story, however, concerns itself chiefly with the main station, 3ZO. It almost ruins

running everywhere from single 5-watters up to sets using four 250-watt tubes? Say, how would you like to be turned loose in such a place for a week or so!

Just such a place Mr. Beale has built for himself at 3ZO. It is impossible to do this station justice in our limited space, and the photographs and descriptions herein can only hope to cover the high-lights of this remarkable station.



The Aerial System at 3ZO

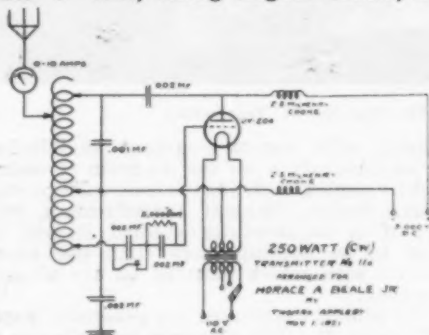
us financially to pay for cuts of 1% of the good photographs available of 3ZO alone, so 3XW and 3OI are reserved for a future occasion.

Say, fellow amateurs, can you imagine a station with a miniature Bureau of Standards for a "shack", a half dozen or so good masts, four or five operating rooms, ten receivers and twenty transmitters, the latter

First off, 3ZO has for its quarters the entire second story of a frame building, especially outfitted for the purpose. There is a main office and operating room, several small sound-proof operating rooms, a complete work-shop, a store room, a sleeping room, a kitchenette—everything. All the walls are lined with sheet zinc for shielding. An elaborate plug and jack system makes

effected on 375 meters with much better results than on the old slanting flat-top.

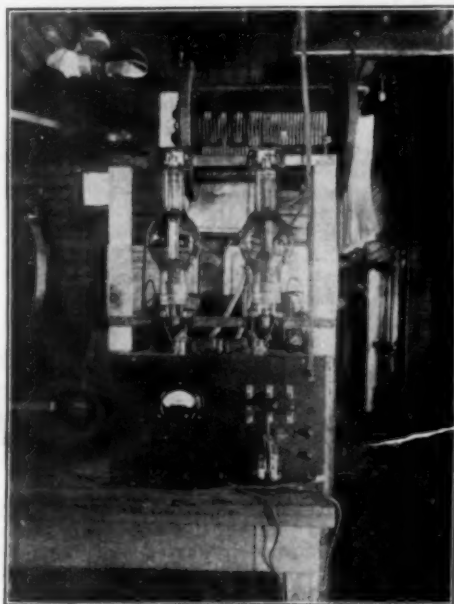
Besides a half-dozen or so DeForest phones and various home-made phones of small power, something like fifteen transmitters have been designed at 3ZO and most of them actually constructed. Not all of them, of course, are still in commission, and we don't even know what some of them were. No. 4 was the spark set as shown in one of our photographs, but this has now been junked and only C.W. is used. No. 5 is a phone using four 50-watt tubes, two as oscillators and two as modulators, which is the beautiful cabinet set with the slanting panel to be seen in the same photograph with the spark, and of which we present the wiring diagram. No. 8, behind the receiving set in the same photo, was a 375-meter telegraph set using four 50-watters in an A.C. self-rectifying circuit. Since the view was made this set has been replaced by No. 8-A, using a single 250-watt "P" tube, wiring diagram shown, also



self-rectifying A.C. No. 11-A is a similar set using one U.V.204 but on 3000 volts D.C., and its hook-up also is presented. No. 13, of which we have a photograph, is a beast employing two 250-watt U.V.204's on 375 meters, also self-rectifying. Then there's No. 14, a 200-meter transmitter

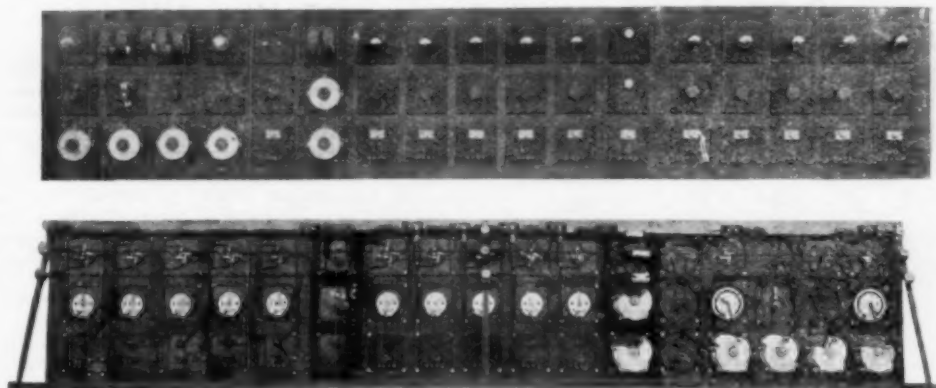
working on a small two-wire aerial we forgot to tell about, which uses two U.V.203's with A.C. on the plate. The diagram for this set is shown too.

No. 11, the pride of them all, is still in course of construction and considerable ex-



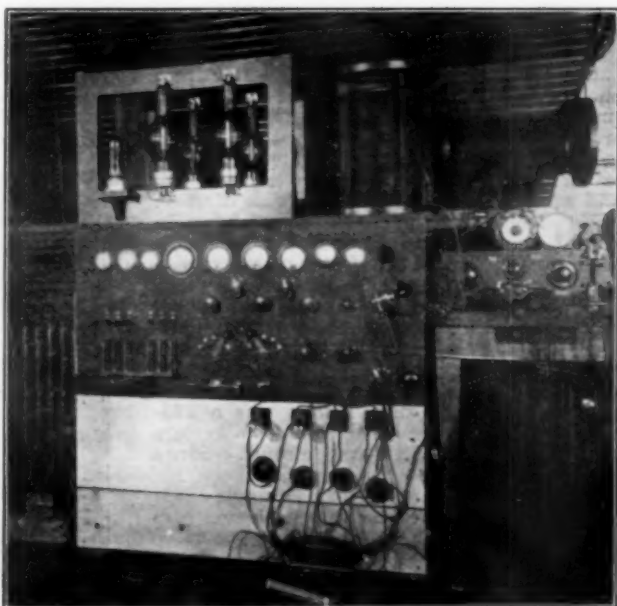
The No. 13 Transmitter

perimenting is being done with it to get all features correct before it is finally built up into a good job, as all of 3ZO's sets are. In the photograph, then, we see a temporary panel of boards on which the various meters and controls are mounted until the preliminary work is completed. This set has a main battery of four 250-watt tubes and is a phone, two of the tubes being



Front and rear views of the Superheterodyne

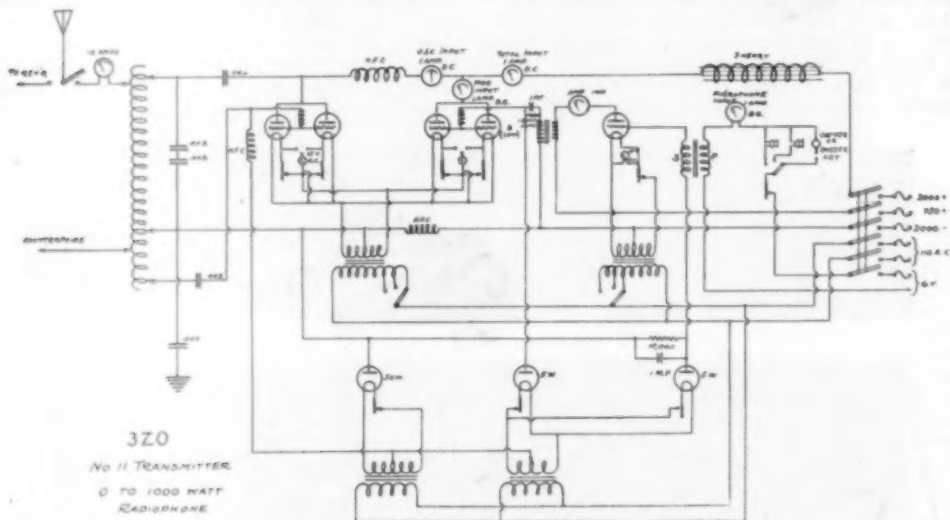
oscillators and two modulators. The 50-watt tube to the right of the big fellows is a speech amplifier. The secondary battery of tubes at the bottom have a most novel function, and the reader is referred to the connection diagram of this set for further details. (This is the way it was the last time we heard from Mr. Beale, but gawdnose what Tom Appleby's done to it by now.) In the hook-up three tubes are seen in the bottom portion—one a 50-watt and the other two 5-watters. In the No. 11 set great trouble was experienced with grid leaks and nothing that would satisfactorily leak the oscillator grids was found until a 50-watt tube was tried for this purpose. The connection from the grids runs to the filament of this tube, its plate completing the circuit to the grounded filaments of the oscillators. Then merely by adjusting the filament brilliancy of the 50-watt "leaker" and hence its electron emission, the resistance is varied and the leakage current controlled. It was found desirable to control the negative bias on the modulator grids and on the grid of the speech amplifier in the same manner (i.e., by a leaky condenser), and the two five watt tubes shown control respectively the modulators and the amplifier. Otherwise the circuit is conventional—a Hartley os-



The Big No. 11 Transmitter

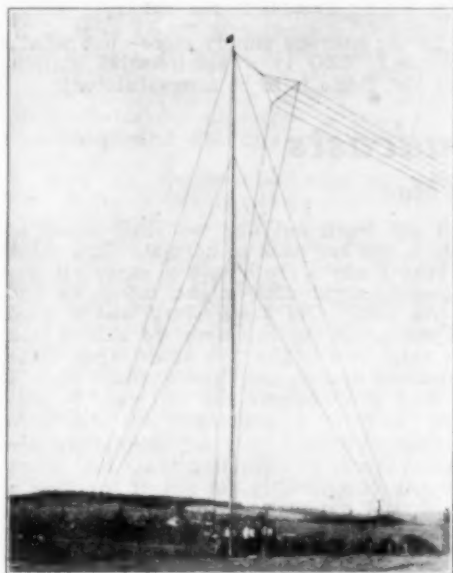
cillator with constant-current modulation. In so elaborate a set the diagram of course looks complex with its various voltage supplies, chokes, filament transformers, etc., but if it is carefully studied it will be seen to be nothing more than the phone circuit with which most of us are already familiar.

We almost overlooked the generator room. Of course it takes a young power-house to supply 3Z0. First there's a 17 k.w. D.C.



machine, giving 110 volt direct current for any desired purposes, and a small Crocker-Wheeler motor-generator unit giving 500 volts, neither of which show in our photo. At the other end of the room are two more machines. We forgot to ask what the one was against the distant wall, being lost in admiration for the beauty in the foreground. This is a special machine, of Eck make, rated at 1.5—2 k.w. at 3000 volts output. At the far end is the induction motor which drives it and at the near end is the separate excitor for the generators, while the latter, two in number, are in between all coupled in a row thru flexible couplings. It is a beautiful machine and incidentally attains full speed in two seconds.

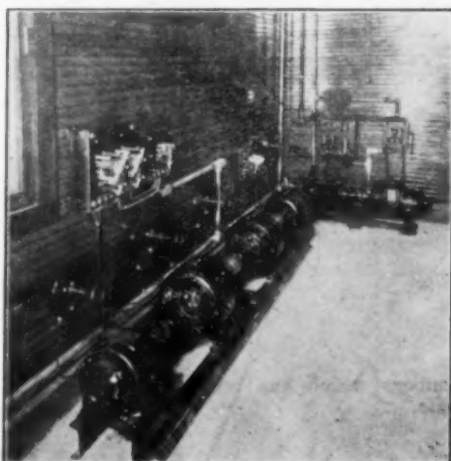
In the line of receiving apparatus 3ZO



How'dya like to have a mast like this?

is almost as well outfitted as it is in transmitters. There's a honeycomb set with built-in detector-three-step, a miscellany of outgrown sets, while the main dependence is put upon a Grebe CR-3 with Grebe companion tube equipment. In one of the smaller operating rooms where the No. 5 phone set is now located is an "Aeriola Senior" operating with two steps of audio amplification which Mr. Beale has built up using the new Westinghouse coated-filament tubes which are a standard part of the "Aeriola Senior", in conjunction with Acme transformers. In another room with the 200-meter C.W. set is a Westinghouse "RC" and likewise an Armstrong superheterodyne built up at the station. This is an immense set, stretching all the

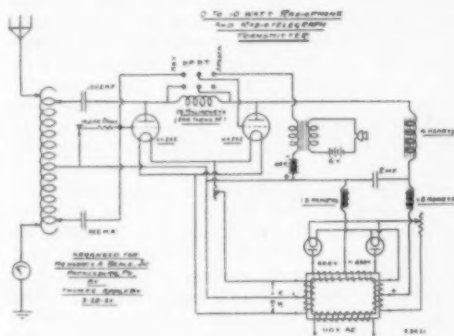
way across the room, and is composed of fifty-one DeForest "units". Referring to the photographs, three sets of honeycomb coils are to be noted. The first two are for



A Corner of the Generator Room

the separate oscillator; the next group of three are for the first detector which by the way uses regeneration, whence the third coil; while the next pair couple on the radio-frequency amplifier of five stages. The last five tubes are audio amplifiers. No provision seems to have been made for a second detector in this set, nor does it appear in the wiring diagram we have, and this probably accounts for the rather unsatisfactory performance so far obtained from it.

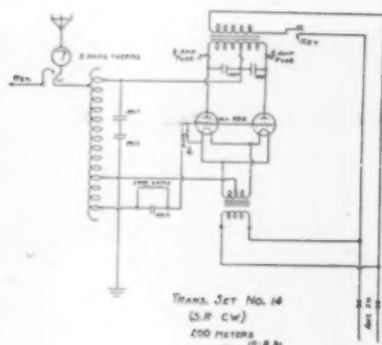
Then there is 3OI, a portable station consisting of a small special house mounted



on a 5-ton truck and sporting a neat little flat-top overhead. Inside the house is a roomy operating table, an oil stove, and a Delco gas-engine lighting outfit which also furnishes juice for sets from time to time installed therein. 3OI is devoted primarily to

the interests of the Chester County Radio Assn., an organization of several hundred

We could go on and on—there's ten times as much equipment and supplies at 3ZO



Portable Station 301

members which has been fathered by Mr. Beale.

as in the average supply store—but what's the use? 3ZO is a monumental station, and Mr. Beale is to be congratulated!

Rotten Broadcasts

By The Old Man

SAY, Son what are we coming to, anyway! If this daggone broadcast stuff keeps on increasing something is going to bust open. The air is so chock full of jingles and jazz and foxtrots and speeches and advice as how to peel potatoes and bedtime bunk that it isn't fit to breathe any more. Darned if I don't think folks will be going crazy pretty soon.

Time was when a man could go home after work, eat his supper and read the paper, play with the kids awhile, and then put the phones on and spend a pleasant evening telegraphing around over the various states, passing the time of day with old friends and making new ones, while the little wife sat alongside fixing the socks and the children's clothes. Now-a-days it takes a brave man to light the bottles and put on the phones. From three hundred meters to four hundred it is one grand smother of stuff they call music and speechifying and what-not, all tangled and snarled up until if you listened to it long enough the bats would begin to show in your belfry, as sure as hellsamantrap. I used to be able to stand for it, when it was only 8XK and later, KDKA, and a couple of amateurs grinding out bum phonograph records. But when the whole blooming country starts to yapping and yowling and hollering, and all of them trying to bawl their heads off on three hundred and sixty meters, it just simply unseats a man's reason. I tell you one thing—if they don't go easy pretty soon, not only will the great American public degenerate into a lot of snickering imbeciles but three hundred and sixty meters

will get worn out and we shall never be able to get her back to normal. Just think of asking any wave length to carry all this hogwash, night after night, month in and month out! Old three sixty was a good old wave, but she will never be able to look her neighbors in the face again when these broadcast hounds get through with her. I swear I don't believe she will ever be able again to carry a respectable dot and dash.

What in blazes they all think they are getting out of broadcasting beats me. What can any one possibly get out of shooting a lot of stuff out that he can't tell about himself? He really does not know if it is getting out good, bad, or indifferent, nor whether any one is listening to him or not. And yet he will squander his money and sit up all night and wear his nervous system down to the quick, building a broadcast station so he can play worn-out phonograph records into it, hour after hour. What possible fun can there be connected with this sort of thing!

It makes my blood boil sitting at my little old set and listening to this butchering of perfectly good radio weather. Who started this foolish business anyway? And what in heaven's name are you chaps up there in Hartford doing, that you let this dagbusted slop get going? You have the Wouff Hong right there at hand. Goshamighty I would have worn the old blunderbuss out before I would have let these musical itsaboos get started. Some day I am going to crank up the flivver and run up there to Headquarters and commandeer that Wouff Hong weapon and also the Bloody Retty-

snitch, which I am told Kruse built down at the Bureau of Standards. Then by Heck, with the Uggerumph between my teeth and possibly with my Old Betsy going along with her wild-cat screech, just to give atmosphere to the occasion, I am going to run amuck among the broadcasters. There will be less and better broadcasting and the fear of God will be in the heart of every designer of a modulation transformer when I get through. By gravy, I have remained quiet for some time, after smashing in the slats of the Young Squirt and strewing his vitals over the landscape, but I'm not going to be meek and humble any longer. My dander has risen, I smell of burning insulation, and nothing but gore and wrecked radio telephone broadcast stations is going to satisfy me.

I don't blame Mr. Hoover for calling a Conference. I would have called somebody a worse name than that. It's high time some conferring was done. In fact, it's time somebody conferred a wallop upon somebody and got this mess straightened out.

Why Mr. Hoover overlooked me and my Old Betsy in this matter passes understanding. Between Old Betsy and me we would have saved a lot of valuable time, and report has it that Mr. Hoover believes in saving time. All that would have been necessary would have been for Mr. Hoover to advertise for every owner of a broadcast station to come to Washington and take his place in the line. Then I would have borrowed a respectable 220 volt, five horse induction motor from "LC" over at NSF and hooked her up to Old Betsy. As fast as Mr. Hoover had questioned the Broadcasters and satisfied himself as to their guilt, I would feed them feet first to Old Betsy. We could have turned the residue over to the garbage collectors to haul away. A couple of days would have done the job. The five horse motor might have to be wiped off before we returned it to "LC" and possible the Old Girl might need some cleaning up, but that would have only taken a few minutes. Think what a lot of trouble would have been sunk for keeps. The air of an evening would have returned to its old-time sweetness. The kids could go on with their Ford coils and their sticky vibrators and their horrible fists, and at ten o'clock we older birds could have come onto the air and handled traffic and have had all the old time thrills and have got enough and gone to bed by midnight. Oh Boy! And to think it used to be that way once!

But 'tis not to be any more. The Secretary of Commerce saw fit to have me and Old Betsy remain in the Eighth District, and instead of spitting on his fists and wading in, with my assistance, he preferred to call in the High Brows and allocate wave lengths and urge in polite language that radio apparatus, controlled lock stock and

barrel by a certain corporation, be freely available and at reasonable prices. That's the gentlemanly way to do it, I confess. But dod blast my suspenders if I believe it will clear up the air around three hundred and sixty meters nor get fifty watt tubes down to four ninety eight in the department stores. Gosh, but I wish he had consulted me in this matter. By Golly, you know boys, I believe I would have made a record on cleaning up that job.

Daggone that squawking soprano at KTPA! She certainly has yowled enough by this time. Gurrdd, but why did she select that thing to sing! Sounds like a funeral dirge badly out of adjustment. I



"I would feed them feet first to Old Betsy"

wonder if the proprietors get samples of the goods before they accept them. Impossible! They certainly never would have put this squall out onto the air if they had heard it first. Some kind of inspection is needed. Zowie, she puts my teeth on edge! Oh dear, I wish I were dead! That female has catawalled now for a full fifteen minutes. Here Kitty, I need thee. Poor woman, I suppose somebody loves you. I'll bet a cooky you haven't an idea in the world what you are doing. Could any woman in her right mind yowl away like that if she realized a quarter of a million of her fellow countrymen were writhing in anguish and wishing to gawd she would hurry up and get it over with. Say, as I sit here smoking myself to death and cursing broadcasting and waiting for the time to come when I can tickle that old key, I can't help thinking of my sins and how different everything is in radio from what it used to be. It used to be that we had only ourselves to fight. It was all in the family then. But now the public are in the game. The dumb-bell with the hundred dollar receiver—the kind that knows no difference between 200 and 500 meters—is the one we must watch now. He wants SILENCE, and doggone little of that, and every time he hears any-

thing in the air except what he wants to hear, whether it is static or induction or a bubbly "B" battery, he froths at the mouth and writes his chum Senator Snigglefritz in Washington that the amateurs are spoiling this wonderful radio which is just beginning, and that a law ought to be passed at once shutting the amateur up. And by Heck, the old fat slob



"Final Authority has started up!"

firmly believes he is right. He really believes that Citizen Radio began with his buying a receiving set and learning how to get KDKA. He never heard of our A.R. R.L. He never has had a glimmer pass over his benighted intelligence that the amateurs ever did anything but annoy broadcast listeners. He is so sunk in black ignorance that he never heard of Paragon Paul Godley, nor 9ZN nor K. B. Warner, nor the Candler of St. Marys, nor the Transcons nor Fred Schnell, nor 4GL, nor by golly, T.O.M. He is a solid citizen and consequently he is a bad one to have fighting you. But some day the light of knowledge will bore through his dome and he will be around wanting to join the Radio Club and asking what's the best way to learn the code.

Listen—yes, the Pittsburgh Yowler has finished. Mr. Flannigan is now going to favor with a violin solo, with Miss O'Houlligan at the piano!! Lord help the poor suffering listeners to-night! Listen to that piano thump, and mind the vacant spots in the violin playing. This will most likely be another ten-minute bout. And all this perfectly good battery juice going to waste. I wonder why I don't kick this junk into the river and take up auction bridge? Gee, but I wish I were dead!

Ohmy gawd Final Authority has started up! That's his fone. I know the sixty cycle hum. Now listen to him count and whistle "Rock of Ages". He's off. His voice sounds as though he were inside a tin

cracker box. Listen to her wheeze. Blots out everything from the bottom of the scale on my tuner up to the top of the long wave coil. Ye gods and little fishes! I simply cannot endure it. Let's put out the bulbs and write a bit to kill time.—Stand still a minute, Kitty.

My next door neighbor has it in for Final Authority. Somehow he found out who was responsible for the big noise in the air and he asked me the other night whether something couldn't be done about him. I remember the occasion when Final got in wrong with my neighbor and it is worth telling, while we wait for the broadcast bull to spend itself. It seems that Final had arranged a coup, as the say in La Belle France. He had copped the big singers at the concert that came to town and after their part of the programme was finished, Final hustled them out to his house and got them to sing into his phone. He had just secured his limited commercial broadcasting license and he thought he was some hot stuff. Some how or other, his phone worked well that night and I will have to confess the singing was pretty good. It woke up the little wife at our house and she paid attention for the first time. She considers most radio phone music as not worth spitting on.

It so happened that on that same night my neighbor decided to give a little phone party at his house. He told me his guests arrived and they waited for KDKA, Detroit



"Wait until the dumb-bells get poisoned with these little dit-dit's"

and Washington and had just heard the "Detroit News" tell something they were going to do, when—crash—bang—Final Authority came rattling the diaphragms with his special concert. Detroit was blanketed, as was everything else. The guests thought it was Detroit and were thrilled to the marrow bones. But Neighbor Jones had to let the cat out of the bag, and he said that when they found that it was only coming from their own town they lost all interest. They wanted to hear De-

troit. The rottenest jazz from Detroit would have been ten times more interesting than the finest stuff the world afforded from their own town. They wanted the thrill of long distance, and I had to smile as I thought of what we amateurs have been through all the past years. The thing that has held us together and kept the interest up year after year has been just this very selfsame long distance stuff. Daggone if I don't believe it's going to be the same with these dumb-bells. They are going to get fed up with the near-by stuff and the concerts and the speeches giving detail specifications as to how to peel potatoes, and one by one they are going to begin wondering about the little chirps and the little buzzings down on two hundred. By and by some of them will get to know the numerals when they hear them, and then they will borrow a call book somewhere, and when they get so they can catch the district the signal is coming from, it will be all off for the cheap broadcast stuff. They will either slough off completely and sell their sets or will get the bug and become amateurs.

That's my guess and I'm not far wrong, for I see the rash breaking out on Neighbor Jones already. Say, isn't it funny, how those little dots and dashes get you? DAH-DAH-DAH-DAH—DIT. DIT-DIT-DIT-DIT-DIT. DIT-DAH-DAH-DAH-DAH. DAH-DAH-DAH-DIT-DIT. Those two quick little DIT-DIT-s on the end mean the good old EIGHTH DISTRICT, and I suppose every fellow has the same home feeling about his own district. Wait till the dumb bells get poisoned with these little DIT-DIT's and it will be all off with the broadcast concerts and the lectures on potato peeling.

Well, it's ten thirty, boys, and there is old 1AW calling 3ALN and telling him "msgs", and his fist sounds like it might be the Old Chief at the key. Gosh, but it sounds good. Guess I better oil up the Old Girl and get in myself. Seems like a good night and we ought to clear the old pin off by the looks.

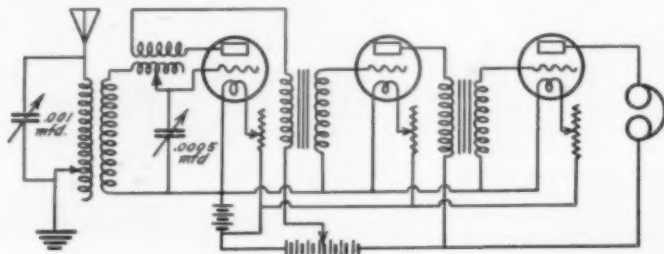
Well, old timers, 73 to all of you, and by Heck let's hold fast to our good old dot and dash stuff. GN SK

An Efficient Tuner for Short Waves

By H. J. Goddard, 9ZX, 9EE

THE short wave tuner described in the following article is offered to the amateur, not as a substitute for an expensive variometer set, but rather as a tuner, easily and cheaply constructed, that will prove nearly if not entirely as efficient as the best standard receivers on the market today. Its range is approximately from 180 to 600 meters, it oscillates freely over the entire wavelength range, and functions equally well

scribed to the writer by Mr. H. J. Burhop, 9ZL, this tuner was designed, so far as I know, by Mr. Melvin Herman, 9FN, and to both of these men I am indebted for the constructional data. I would not go so far as to say that this tuner is better than the variometer set in question; but I do say that in my case at least, it has proven only slightly less sensitive than the variometer set and considerably more selective.

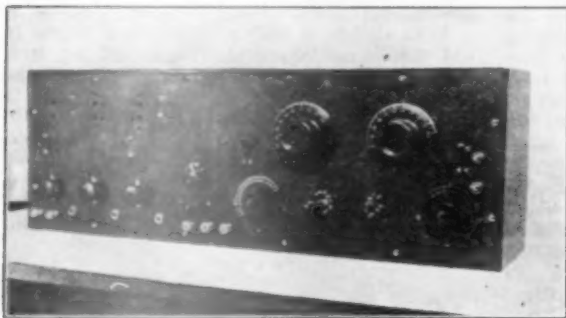


for spark, C.W. or phone reception giving wonderful amplification of all signals. It belongs to the tickler type of receiver and uses single-layer coils as inductances. It has been pointed out to the writer that its dead-end losses and the use of capacities are detrimental to efficiency; but, be this as it may, the amateur who constructs one of these tuners is very likely to do as have several others who have tried it—discard his variometer set. Originally de-

Briefly, the tuner consists of four coils. These coils may be wound upon cardboard tubes if desired but bakelite or formica tubing on account of its greater strength and permanence is to be preferred. Two of these tubes are 5 inches inside diameter and two are 4 1/4 inches inside diameter. All four are 1 1/2 inches in length (or width). Upon one of the 5 inch tubes is wound 24 turns of No. 26 DCC wire tapped every 6 turns (4 taps). This is the primary wind-

ing. The other 5 inch tube is made up exactly the same as the first and constitutes one half of the secondary winding. Upon one of the smaller tubes wind 24 turns of No. 26 DCC, but taking off no taps; this is the second half of the secondary winding. The remaining small tube is wound with 36 turns of No. 26 DCC, no taps. This is the tickler winding. The direction of winding is immaterial, but all windings may well be in the same direction.

The untapped portion of the secondary



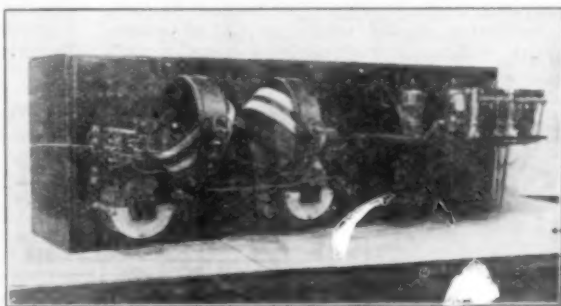
is now mounted upon shafts so that it will rotate within the primary winding. In like manner, the tickler winding is mounted to rotate within the tapped portion of the secondary. We now have what amounts to two variocouplers. These are mounted upon the panel, the two portions of the secondary connected in series and the primary and secondary taps brought out to switches upon the panel. The ends of the tickler winding are connected to the plate and phones as usual; the terminals of the secondary are attached to the grid and filament, and the primary connected to the aerial and ground. A 43-plate variable condenser is connected through a switch so that it may be placed either in series or shunt with the primary and a similar condenser, but of 23-plate size, is arranged so that it may be either shunted across the secondary or cut out altogether. The writer recommends that condensers equipped with verniers be used since the set tunes very sharply.

Suggestions on Operation

To a person unaccustomed to this tuner, it is likely to be disappointing at first. Its selectivity is such that it may be discarded before it is given a fair trial. It is usually best to bring the tickler control nearly to the oscillating point at the outset then varying the primary and secondary controls until the signal is heard, then reducing re-

generation slightly until the adjustment of the primary and secondary are completed and the signal strength is the greatest that can be obtained without oscillation. In general, let the inductance predominate. If now the tickler control is manipulated the signals will come in greatly amplified. This tickler control, however, is very critical and a change of even one degree on the scale will make a world of difference.

It will be noted from the accompanying photographs of the writer's set that the condensers are mounted upon the lower portion of the panel. This disposition of the condensers places them where they may be controlled with the arm resting upon the operating table being especially valuable in following a swinging signal which can usually be done by varying the vernier of the secondary condenser without touching the other controls. It might be pointed out that the writer's set is built left-handed; in other words the condenser and switch at the right control the primary while those on the left control the secondary. This left-handed feature is carried throughout the entire set, the right hand tube being the detector, and successive stages of amplification being disposed at the left of the detector. This places the most frequently used controls nearer the body and in the most convenient position relative to the transmitting key. It will be found advantageous to shield the panel, at least in front of the tuner proper, either with tinfoil or copper sheets, these being



grounded. Shielding of some sort is almost a necessity; but the writer finds that shielding of the secondary condenser alone answers very well.

In conclusion the writer wishes to say that he will be very glad to answer any questions regarding the construction or operation of this tuner that may occur to the prospective builder.

The Governors-President Relay

By K. B. Warner

AMATEUR radio again demonstrated its capabilities, and at a most opportune time in the legislative situation, in our A.R.R.L. Governors-President Relay on March 6th, 7th and 8th when messages to President Harding were received and delivered at the White House from forty of the forty-eight states. Messages failed to start from five of the remaining states, while three started but failed for one reason or another to reach Washington. Considering the bad weather that prevailed during much of the tests, that is a splendid performance and again we have the consciousness of a hard job well done.

The Scheme

As announced in an earlier QST, the preliminary arrangements were very simple. Our Operating Department prepared a schedule of starting times and the Division Managers were asked to solicit or arrange for the securing of a message to the President from the Governor of each state in their respective Divisions. No hard and fast rules applied in this relay and the work was individual in each state, making real co-operation count. There was no fixed plan for handling the messages, no predetermined routes; they were to move on each of the three nights as opportunity afforded, in all the flexibility of routine relaying. The plan was remarkable in its success and we amateurs showed again that we are what one of the Governors called us: "Minute Men of radio".

The Receiving Machinery

The Washington end was beautifully organized by the Washington Radio Club under the administration of its president, H. A. Snow, 3ZE. At a club meeting two nights before the tests the plans were completed and 3IL, Strang, the club's chief operator, selected as a concentrating station for the delivery of the messages; 3IL and 3ZE as control stations, and 3ZY and 3ALN as the operating stations to work with outside stations who had the messages. Both 3ZY and 3ALN are C.W. and do not interfere with each other. 3ZY was manned by its owner, L. M. Dunnam, and H. J. Wadsworth of 3JJ, while the operators at 3ALN were its owner, H. F. Hastings, and Snow of 3ZE. A perfectly working machine was the result and but one case of avoidable interference marred the performance.

On the first night, March 6th, the atmospherics were awful and logs from all over the country show that operating conditions were generally rotten thruout the land. Nevertheless 8 messages got thru these

almost impossible conditions, one direct from a state capital in the form of Connecticut's message which was picked up from 1AW by 3ZE, while 7 others came in by various routes. On the second night static was still bad at 10 p.m. but practically nil after midnight, and messages from 15 additional states were received besides a second receipt of many of the previous night. On the night of the 8-9th the air was very good and a total of 17 more states were corralled, making 40 in all. With 5 not starting and 3 failing to arrive we account for our 48 states. During this



last night as time grew short the gang automatically QSK's messages they knew were safe in Washington the preceding nights, relieving the air of this extra traffic, and all hands concentrated in an effort to locate the missing messages.

3ZY was the star of the Washington team with credit for 27 messages received, while 3ALN got 12; and one, Connecticut's, was received direct by 3IL and 3ZE. Out-of-town honors in the eastern states where the messages were concentrating go to 9ZJ, 4GL, 8AXY and 3ZO.

Delivery of the Messages

A little unfortunately for us, right in the midst of the relays the President left Washington for a short vacation in Florida and was out of the city upon the conclusion of the tests. The messages were delivered at the White House on the 9th by the Washington Radio Club, accompanying the following letter, but had to await his return to the city.

2020 First S., N. W.,
Washington, D. C.
March 9, 1922

Sir:

The attached forty messages from Governors and State officials have been handled entirely by amateur radio operators who are members of the

American Radio Relay League. They are the result of a three days relay known as the "Governors'-President Relay" which was instituted and operated under the supervision of the League. The traffic was handled on the nights of March 6, 7 and 8 in accordance with the plan of operation mapped out by the Traffic Manager. Reception at Washington was effected by two stations of members of the Washington Radio Club which is affiliated with the American Radio Relay League.

The members of the League are always at your command and are willing to do anything in their power to further the interests of their country.

Very respectfully,

(signed) Harry L. Strang, Chief Operator,
The President, Washington Radio Club
The White House

Upon his return the President acknowledged the messages with the following letter:

The White House,
Washington,
March 21, 1922

Mr. Dear Mr. Strang:

Returning from his brief southern trip, the President finds the radiograms of greeting from the Governors of States, which were gathered thru the interest and activity of the American Radio Relay League, and forwarded to him.

Availing himself of the courtesy extended by you, he will be glad if your organization will convey to the Governors his appreciations and thanks for their kindly expressions. He wishes me also to thank all the members of your organization who have participated in bringing to him this remarkable greeting.

Very sincerely,

(signed) Geo. B. Christian, Jr.,
Secretary to the President.

The Messages

The messages are so interesting that we publish their full text below. We sincerely wish it were possible to give the complete routing of each message but logs are insufficient on some, the fact that some messages were duplicated on successive nights makes it impossible to identify the route of any given night's message, some moved by several routes, and in many cases they were copied out of the air by eastern stations and plunked into Washington ahead of their routine appearance. We will give with each message a list of stations known to have participated in its handling on some one of the three nights as gathered by an inspection of logs at hand, but wish it understood that the lists are not complete and in no sense accurately portray the route over which the respective message moved.

ALABAMA—Montgomery, Mar. 8.—His Excellency, Warren G. Harding, Washington, D. C.—Congratulations on reserve of radio minute men for national emergencies.—Thomas E. Kilby, Governor of Alabama. Moved 5XA to 4GL to 3ZY.

ARIZONA—Phoenix, Mar. 7.—Hon. Warren G. Harding, President, United States, Washington, D. C.—Congratulations on the magnificent heights of your first year's administration.—Thomas C. Campbell, Governor of Arizona. Some real participation in this one: 6AAH, 6ZZ, 5IF, 9DSD, 9ACB, 90X, 8BBU, 8VN, 8VY, 8AGO, 8AXY, 8AJN, 8ZU, 4GL, 9KO, 8WV, 9DMJ, 8AGZ, 4ZC, 3ZY.

ARKANSAS—Little Rock, Mar. 8.—President Harding, Washington, D. C.—Greetings and felicitations on prospect of freeing ourselves of shackles of miles and slow delivery.—Thomas C. McRae, Governor of Arkansas. Known to have passed thru 5JD, 8AOI, 9AGR, 8FT, 8AJV, 8AJX, 8BBU, 8AXY, 8ALN.

CALIFORNIA—Sacramento, Mar. 8.—President Harding, White House, Washington, D. C.—California sends heartiest greetings and best wishes to you and Mrs. Harding.—William D. Stephens, Governor of California. Credited to 6GF, 7MF, 6ZX, 6ZAM, 9AVZ, 5ZA, 9DZJ, 9ZJ, 3ZY.

CONNECTICUT—Hartford, Mar. 8.—President Harding, Washington, D. C.—Connecticut congratulates you upon your assured success of national conference so ably led by you.—Everett J. Lake, Governor of Connecticut. 1AW to 3ZE.

DELAWARE—Dover, Mar. 7.—President Warren G. Harding, White House, Washington, D. C.—Greetings and best wishes from the state of Delaware.—William D. Denney, Governor of Delaware. 8ZO and 3ZY.

FLORIDA—Tallahassee, Mar. 7.—President Warren G. Harding, White House, Washington, D. C.—The people approve your efforts to promote world peace. Congratulations.—Cary Hardee, Governor of Florida. 4II to 3ALN, direct.



GEORGIA—Atlanta, Mar. 6.—President Harding, Washington, D. C.—Greetings to President and Mrs. Harding from Governor and Mrs. Hardwick.—Governor and Mrs. Hardwick. Handled by 4AU, 3AJD, 8BDB, 3ARN, 4FT and 3ZY.

IDAHO—Boise, Mar. 7.—President Harding, Washington, D. C.—Cordial greetings from the state of Idaho.—D. W. Davis, Governor of Idaho. Early routing unknown: 9VAE to 9ZJ to 3ZY.

ILLINOIS—Springfield, Mar. 8.—President Warren G. Harding, Washington, D. C.—Accept Illinois greetings and heartfelt thanks for your efforts to insure world wide peace.—L. N. Small, Governor of Illinois. Direct 9ASL to 4BY to 3ZY.

INDIANA—Indianapolis, March 7.—President Harding, Washington, D. C.—Greetings from Indiana to the honored President of the United States. Congratulations on the splendid accomplishments your first year.—Governor McCray of Indiana. 9ZJ to 3ZY.

IOWA—Des Moines, Mar. 7.—President Warren G. Harding, The White House, Washington, D. C.—Accept the salutations of the State—Iowa wishes you all happiness.—N. E. Kendall, Governor of Iowa. Passed thru 9DEH, 9AFW, 9AAW, 8WD, 2FP, 3ZY.

KANSAS—Topeka, Mar. 7.—President Warren G. Harding, Washington, D. C.—Kansas sends cordial greetings and felicitations.—Henry J. Allen, Governor of Kansas. Try to figure this out: 9RV, 5MZ, 9DZQ, 8AOR, 5OI, 5XU, 9HI, 9DTA, 9DZQ, 9IF, 8AOI, 9AGR, 8FT, 8AJV, 8AJX, 8ZO, 3ZY.

KENTUCKY—Frankfort, Mar. 7.—President Harding, Washington, D. C.—I am happy to send you the greetings of your thousands of friends in Kentucky.—Edwin P. Morrow, Governor of Kentucky. 9IO, 9EI, 9OX, 9AAW, 8BBU, 4GL, 3ZY.

LOUISIANA—Baton Rouge, Mar. 7.—Hon. Warren G. Harding, Washington, D. C.—American soil and American genius are the cornerstones of American greatness.—John M. Parker, Governor of Louisiana. 5AA, 5JD, 5XU, 9ZJ, 3ZY, 5ZU, 4GL,

5ABA, 8AOL, 9AGR, 8FT, 8AJV, 8AJX; but also direct 5LA to 3ZY.

MAINE—Augusta, Mar. 8.—Warren G. Harding, President, White House, Washington, D. C.—I congratulate you upon your first years administration and send you and Mrs. Harding greetings from the state of Maine.—Percival Baxter. 1APO, 1BHJ, 1BRQ, 1ARY, 3FM, 3ZO, 3ZY.

MARYLAND—Annapolis, Mar. 6.—President Harding, White House, Washington, D. C.—The Governor and people of Maryland send their greetings and best wishes to President Harding.—Governor Albert C. Ritchie. 3AJD to 3ALN.

MASSACHUSETTS—Boston, Mar. 6.—Warren G. Harding, President United States, White House, Washington, D. C.—Cordial greetings from Massachusetts which remains steadfast in support of your earnest and successful efforts to establish peace in the world and better conditions at home.—Governor Channing C. Cox. 1XM, 1ZE, 1COA, 1SN, 2OM, 2BEA, 3ZY.

MICHIGAN—Lansing, Mar. 8.—Warren G. Harding, President United States, Washington, D. C.—I take the opportunity afforded to me by amateur radio operators of the country of sending to you my heartiest greetings and well wishes.—Alex J. Groesbeck, Governor of Michigan. 8ZF, 8ZZ, 8BO, 4GL, 3ZY.

MINNESOTA—Minneapolis, Mar. 8.—President Harding, Washington, D. C.—The state of Minnesota greatly interested in development of radio and appreciates all that you and your administration are doing in its behalf.—J. A. O. Preus, Governor of Minnesota. 9XI, 9ZJ, 3ZY, 9YAE.

MISSOURI—Jefferson City, Mar. 6.—Hon. Warren G. Harding, President, Washington, D. C.—Through our Missouri marketing bureau broadcasting station I salute you by wireless.—Arthur M. Hyde, Governor of Missouri. 9ACB, 9ARQ, 9ZB, 5XU, 9YM, 9ZJ, 3ZY.

MONTANA—Helena, Mar. 7.—President Harding, White House, Washington, D. C.—Montana is confident of her future under your administration—Montana sends greetings.—Story, Lieutenant Governor. 7XB, 7ZU, 7LY, 9AVZ, 9HL, 9DMJ, 8WL, 8AXY, 3ALN; also 9YAE to 9ZJ to 3ZY; also 9WU to 8BO to 4GL to 3ZY.



NEBRASKA—Lincoln, Mar. 8.—President Warren G. Harding, Washington, D. C.—Sincere good wishes for success in problems that confront you.—F. A. McCoove (instead of Gov. McKelvie.) 9AGR, 8AOL, 8FT, 8AJV, 8ATX, 8BBU, 8AXY to 3ALN.

NEVADA—Reno, Mar. 8.—President Warren G. Harding, Washington, D. C.—Greetings from Nevada transmitted by the nation's brightest boys and girls.—Emmett D. Boyd, Governor of Nevada. 6QR, 6AAH, 6QR, 7LY, 7ZU, 9AVZ, 9WI, 9DEH, 9AAW, 8EB, 9YAE, 9ZJ, 4GL to 3ZY.

NEW HAMPSHIRE—Concord, Mar. 7.—Warren G. Harding, President United States, Washington, D. C.—For peace and the hope that it inspires New Hampshire is profoundly grateful.—Albert O. Brown, Governor of New Hampshire. 1BAE, 1ADL, 1SN, 1XM, 1ADT, 2TS, 3ZO, 3ZY, 8XE, 1AW to 3ALN.

NEW JERSEY—Trenton, Mar. 7.—President Harding, Washington, D. C.—I welcome the opportunity to extend greetings by the latest demonstration of the genius of our youth—the wireless.—Governor Edwards. 3ZO to 3ZY.

NORTH DAKOTA—Bismark, Mar. 8.—President Harding, Washington, D. C.—North Dakota con-

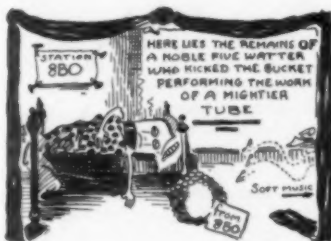
gratulates you on your stand on the Great Lakes to St. Lawrence tidewater route believing the completion of such a project will materially aid in the development of this great northwestern country.

—R. A. Nastos, Governor of North Dakota. 9FX, 9WU, 8BO, 4GL, 3ZY.

OHIO—Columbus, Mar. 7.—Warren G. Harding, President of the United States, Washington, D. C.—Benefit of wireless such as to warrant every possible encouragement.—Governor H. L. Davis. 8BBU, 8AXY to 3ALN.

OKLAHOMA—Oklahoma City, Mar. 7.—President Harding, Washington, D. C.—May your efforts to limit armaments be successful.—J. B. A. Robertson, Governor of Oklahoma. 5HK, 9DMJ, 8ARD, 9CS, 9AAW, 9WI, 8WD, 2FP to 3ZY.

OREGON—Salem, Mar. 8.—President Harding, Washington, D. C.—Boys of the Radio Association of Salem, Ore., branch of the A.R.R.L. ask me to convey greetings for them to you by radio and extend to your their most sincere compliments and good wishes.—Ben W. Olcott. 7MP, 6AGF, 9IF, 9DTA, 5XU, 9ZJ, 3ZY.



PENNSYLVANIA—Harrisburg, Mar. 7.—Warren G. Harding, President, White House, Washington, D. C.—My dear Mr. President—It gives me pleasure to extend to the President of the United States the greetings of nine million loyal and patriotic Pennsylvanians—I am pleased indeed to assist amateur radio operators in their efforts to popularize this very important system of telegraphy—Cordially yours.—William C. Sproul, Governor of Penn. This "book" via 3AGT, 8AQR, 8AAY, 3ZO and 3ZY.

RHODE ISLAND—Providence, Mar. 6.—Hon. Warren G. Harding, Washington, D. C.—Heartiest congratulations and best wishes for future.—Emery J. SanSouci, Governor of the state of Rhode Island. Only record 3AID to 3ALN.

SOUTH DAKOTA—Pierre, Mar. 8.—President Harding, White House, Washington, D. C.—Appreciating value of wireless and interested in A.R.R.L. South Dakota sending greetings.—W. H. McMaster, Governor of South Dakota.—9DEH, 9AAW, 8EB, 7LY, 7XB, 5HK, 9DMJ, 9WI, 9DSD, 9AVZ, 9FI, 8AXY to 3ALN.

TENNESSEE—Nashville, Mar. 8.—President Warren G. Harding, White House, Washington, D. C.—No better service to the country could be performed by Congress and your administration than to authorize the completion of the Muscle Shoals project and the acceptance of Ford's offer to lease it.—A. A. Taylor, Governor of Tennessee. 5FV, 8SP, 3ALN.

TEXAS—Austin, Mar. 7.—President Harding, Washington, D. C.—The federal prohibition law permitting federal judge to assess light punishment for violation of that law encourages those criminally inclined to become professional bootleggers.—Pat M. Neff, Governor of Texas. 5ZU, 4GL, 9YAE, 9ZJ to 3ZY.

UTAH—Salt Lake City, Mar. 8.—President Harding, Washington, D. C.—Best wishes for the success of the national relay.—Chas. P. Mabey, Governor of Utah. 6TJ, 6SJ, 6AFD, 9XAQ, 9APN, 9YAE, 9ZJ to 3ZY.

VERMONT—The President of the United States, Washington, D. C.—Greetings and best wishes from the Green Mountain State.—Jam. A. Hartness, 1ARY, 2AAR, 3FM, 1XU, 3ZO, 3ALN, 3ZY.

VIRGINIA—Richmond, Mar. 7.—President Warren G. Harding, Washington, D. C.—May I take

advantage of this opportunity to send you greetings on behalf of the Old Dominion?—E. Lee Trinkle, Governor of Virginia. 3BLF, 3ZY.

WASHINGTON, Olympia, Mar. 8.—President Harding, Washington, D. C.—Congratulations on a successful year.—Louis F. Hart, Governor of Washington. 7ZP, 7BC, 7BK, 7VZ, 7HL, 7XB, 9YAE, 9ZJ, 3ZY.

WEST VIRGINIA—Charleston, Mar. 8.—Pres. Warren G. Harding, White House, Washington, D. C.—West Virginia sends greetings by radio to President Harding.—E. F. Morgan. 8SP to 3ZY.

The Messages That Didn't Arrive

Some of the governors were out of town, some ill and some too busy, and three messages got hung up en route, so that eight states were not heard from in Washington:

COLORADO—None of the logs received report anything on this message and it is believed that it never started.

MISSISSIPPI—Didn't start on Mar. 6th or 7th but left 5YE at 11:15 p.m. C.S.T. on the 8th and apparently got stalled in the Ninth District until too late.

NEW MEXICO—No message furnished by the governor in response to the District Superintendent's request.

NEW YORK—It is difficult to believe that New York's message could have failed but such is the case. It left Albany via 2PV, to 2BM in Hudson, N. Y., who gave it to 2DA in Poughkeepsie on the last night. The latter acknowledged it and endeavored to QSR but finding it impossible to raise anyone thru the QRM, and knowing it was the last night, endeavored to QSK it back to 2BM. We must record that the message was stuck at 2DA.

NO. CAROLINA—The governor declined to take part and no message was started.

SO. CAROLINA—No message started.

WISCONSIN—Instructions to District Superintendent miscarried and no message was secured from the governor.

WYOMING—Message left 7ZO on the 7th to 9WI, who gave it to 9DMN. Later it was recorded at 9AZA in Wisconsin, who was heard late on the last night making valiant efforts to unload it on somebody east but to no avail, and it died there, to the best of our records.

Gleaned From Logs

That Arizona message must have been greased. It went thru to the east every night with precision. On one night for example we definitely disclose its relaying thru five stations in an elapsed time of 13 minutes. That's real relaying! Not only did the Arizona fellows see their message moving nicely by "short" jumps but on the last night 6ZZ on his C.W. gave it direct to 8AGZ in E. Cleveland, whom he works regularly, a distance of 2000 miles. The latter couldn't raise anyone in Washington, however, and in desperation gave it to 4ZC in Florida, who QSR'd.

A few of the routes traversed were ludicrous. For instance the New Hampshire went to 1XM on the first night but apparently died there and on the second

night 1ADL gave it to 8XE in Pennsylvania as the only DX he could raise. The latter heard 1AW working Washington and so passed it back to New England, making the perfectly wonderful routing 1ADL-8XE-1AW-3ALN. Sounds more like tennis.

9ZJ, Indianapolis, has the distinction of being the station putting the largest number of messages into Washington for their first official receipt there. His log is interesting:

"Mar. 7-8. 11:17 p.m. Mo. msg. recd fm 9YM. 11:33 p.m. Texas msg. from 9YAE. From 1:20 to 1:25 a.m. worked 3ZY, giving him Mo., Tex. and Ind. msgs. 1:41 a.m. Idaho messages from 9YAE. Gave this to 3ZY at 2:02 a.m.

"Mar. 8-9. Fine night. 11:06 p.m. Washington msg. from 9YAE. 12:20 a.m. Minn. msg. from 9YAE. 12:30 a.m. Mo. msg. from 5XU. 12:32 a.m. Minn. msg. again from 9XI. 12:34 a.m. Ore. msg. from 5XU. 12:38 La. msg. from 5XU. 1:14 a.m. Utah's from 9YAE. From 1:45 to 2:10 a.m. worked 3ZY, giving him Utah, La., Ore., Minn., Mo., Wash., and Ind. msgs. 2:18 a.m. Nevada's de 9YAE. 2:35 a.m. Calif.'s from 5ZA. Gave Cal. and Nev. msgs. to 3ZY at 2:50 a.m. 3:02 Mont. msg. from 9YAE; gave this to 3ZY at 3:14 a.m." (All figures in Eastern Time.)



9YAE did great work in the northwest country, handling the messages from Texas, Idaho, Washington, Minnesota, Utah, Montana and Nevada—all passed to 9ZJ.

8BO with a single 5-watt tube covered some remarkable distances, handling the Montana and North Dakota messages from 9WU in Ellendale, N.D., and the Michigan message from 8ZZ. On the 8th, calling 3ZY, 4GL replied with a "Shoot" so he stepped on 'er and 4GL QSL'd for 1, 2, 3 in his w.k. style. 8BO had barely given his "tnx nil nw" when the only 5-watter on the premises gave a sigh and turned over dead. It was a great end for a good tube and 8BO thanks his Lady Luck it held out until he QSR'd. Some distances for real relaying on one tube.

Another remarkable bit of C.W. work

was that of 5LA, New Orleans. 5ABA in Baton Rouge, securer of the message, phoned it to 5LA as his set was "out". 5ZAB, the starter, failed to start the message and 5LA as substitute dumped it right into 3ZY at 10:35 p.m. on the 7th and again on the next day he did the same thing at 10:09 p.m. 5LA uses three 5-watters with 1.9 amps. in the aerial.

1SN had a rotten time with the Massachusetts message on the second night. All evening long he tried to raise somebody who could copy him but no soap until 1:36 a.m. when finally he got a GA from 2OM. After resending some jammed parts he got an OK at 2 a.m. and his log shows his relief: "The rep of Mass. is saved—by 2OM, hero!"

5ZU got the Texas, Louisiana and Arizona messages and, hearing 4GL cranking that Ford of his, dropped them on him at 30 per and got the usual "OK 1, 2, 3". Three minutes later he had the satisfaction of hearing his messages going north from 4GL. Hill did good work, a batch of the messages passing thru his station.

That Utah message could tell a rotten story. 6ZAJ started it to 7MP on the 6th and was about half way thru it when the power went off. The trouble wasn't located for several days, when it was discovered that a neighbor had cut one of his distant-control wires to stop the lights flickering. What an opportune time! Meanwhile 6ZAJ phoned the message to 6SJ in Salt Lake but the latter blew his condenser when he tackled the job and had to phone it to 6AFD. Finally it got started via radio at 10:20 Mountain Time on the 7th, 6AFD to 9XAQ to 9APN, and reached Washington OK on the last night.

3ZO relayed the Penn., New Jersey, Delaware, Kansas, Vermont, New Hampshire and Maine messages. At 1 a.m. on the 9th he learned that the messages from Maine and New York had not yet reached Washington and made special efforts to pick them up. The New York one never was found but the Maine one was got from 3FM at 2:15 a.m. and given to 3ZY at 2:34. It didn't leave Maine until the last night, suffering various delays in local stations before it left the state.

9AVZ of Pierre, S.D., pulled a good one. On the second night he had the Nevada message safe on his pin and—but let his log tell the story:

"12:05 a.m. Went to bed and set alarm for 2 a.m.

"7:05 a.m. Woke up. Didn't hear alarm at 2 o'clock. And Nevada message still on the hook! Called CQ but nobody on."

But he got it off OK that night to 9WII

Acknowledgments

The greatest praise and thanks are due the Washington Radio Club for the good work that made possible the success of these tests. We understand the fellows there, particularly the ones officiating in the relay, are forming a Sun Dodgers chapter of the Boiled Owl fraternity, and none will dispute their eligibility!

Thanks and congratulations are extended all the participating stations, and Headquarters also wish particularly to thank the large number of operators sending in logs for the nights in question, whose kindness in this respect has made available the data for this article.

Police Chiefs Relay

By F. H. Schnell, Traffic Manager

DURING the month of March we enjoyed the success of the Governors-President Relay, which was the gathering of a number of messages and delivering them to one central point. The Police Chiefs Relay will be just the reverse of that. We are going to have one message which is to be distributed all over the United States and Canada by the A.R.R.L. and DELIVERED to your police chief.

The International Association of Chiefs of Police will meet in San Francisco during the week of June 19th. Chief August Vollmer, who is head of the organization, is going to invite every police chief to the convention and he is going to invite him by amateur radio. He will send a message which can be given to your police chief by

you and he is counting on the A.R.R.L. to DELIVER this message to every police chief in every village, hamlet, burg, city or town in the United States and Canada. WE CAN AND WILL DO IT. We must DELIVER it or the police chief will be without an invitation. We could set down definite schedules for the handling of this message but in order to derive some fun and a great deal of competitive sport from it we want every A.R.R.L. member to do his bit towards the success of the relay. Therefore there will be no schedules, no definite stations to handle it. We shall be "minute men of radio". We are going to have some real fun and plenty of excitement. Don't miss it! It makes no difference if you operate just a receiving station—you can supply messages and DELIVER them

and that is all that is necessary. There will be plenty of transmitters.

Here is the scheme:

Dates—June 3rd, 4th, and 5th.

Time—Sometime between 10:00 P.M. and midnight your local standard time some station will break loose with the message. The call letters of this station and the time of starting will not be made known. The message will come as a surprise right out of a clear sky. It will be broadcast once at ten words a minute, each word being sent twice. Once a station broadcasts the message, that station will cease firing. That will be the start of the message.

The next thing to do is to copy it exactly as it is sent. Make at least two copies of the message. Then DELIVER one copy immediately to your police chief and have him sign the other copy with the date and time of receipt. (Have a heart and don't get him out of bed at two or three in the morning; get one of his representatives to sign for the message if the chief cannot be reached at that ungodly hour.) The copy of the message bearing the signature of the recipient must be sent to the Traffic Manager, 1045 Main St., Hartford, Conn., in

order that we may determine how many messages were delivered. This is very important. After you have DELIVERED your message and gotten your receipt, it is your turn to broadcast the message sending at the rate of ten words a minute and repeating each word twice. After you have broadcasted it once, cease firing.

The things to remember are these—make two copies of the message; DELIVER one to the chief and get his signature on the other; return the one bearing the chief's signature to A.R.R.L. headquarters (THIS IS MOST IMPORTANT BECAUSE IT IS THE ONLY WAY WE CAN DETERMINE THE EXACT NUMBER OF MESSAGES DELIVERED—DON'T NEGLECT THIS—WE WANT TO DELIVER ONE IN EVERY PLACE THAT BOASTS A POLICE CHIEF OR SHERIFF); broadcast the message only once sending each word twice at ten words per minute—give the little fellows a chance to copy it. Be sure and include your call letters when you send the copy of the message to the A.R.R.L. that we may give credit to every station DELIVERING a message. You yourself must report this.

An Electromagnetic Changeover Switch

By Harold L. Olesen, Ex-2BQT

IN laying out a station the owner generally finds that he has the choice of a long roundabout antenna lead and the changeover switch within easy reach of the receiver or a short direct antenna lead and the changeover switch out of reach. Obviously each layout has its advantage and likewise its faults. For the owner who is going to do a lot of work the out of reach changeover switch is a bother—it delays coming back and generally means jumping up to reach the switch. On the other hand the indirect antenna lead often causes trouble and is to be avoided whenever possible.

The photograph shows a very simple device that puts an end to the antenna changeover switch location problem. It consists of a double pole double throw switch operated remote control by the aid of solenoid magnets. The construction is so simple that no detailed drawing need be given. The following notes will be of general interest.

Size of switch base 1x8x11"

Size of blades $\frac{1}{8}$ x $\frac{3}{8}$ x7 $\frac{1}{2}$ "

Distance between blade pivot centers 3 $\frac{3}{4}$ "

Size of solenoid tube 1x9" $\frac{1}{8}$ " thick

Size of each coil 2x3x $\frac{1}{4}$ "—wire only

Size of plunger $\frac{3}{4}$ x3 $\frac{1}{2}$ "

Wire—about one pound of #26 DCC on each coil when used on 110V. A.C.

Trumbull switch lugs used by remounting them on fibre blocks.

The coils must be spaced apart slightly so as to make the centers of the coils far enough apart that the plunger will be out from under one center when under the other. The length of travel of the plunger is determined by the distance between coil centers.

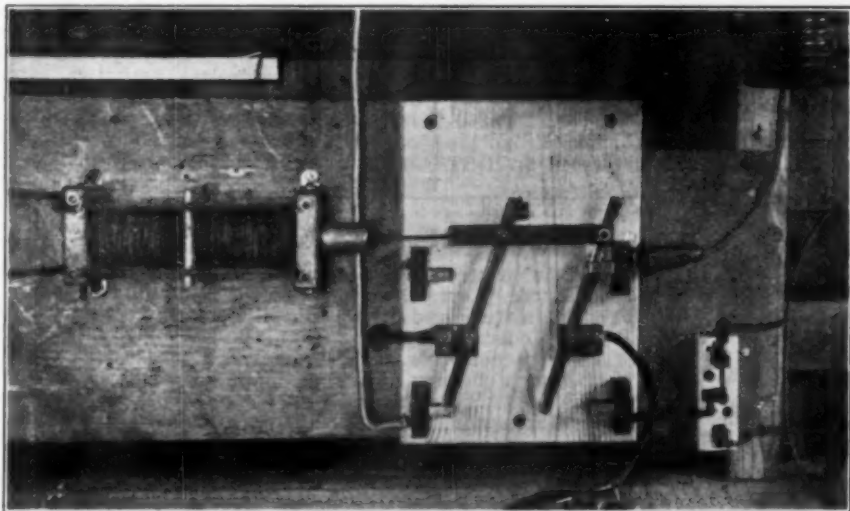
The easiest way to adjust the finished switch is to change the length of the arm that connects the plunger to the cross arm on the switch blades. Shorten it if the blades do not travel far enough to the right and lengthen it if they do not travel far enough to the left.

It is important that the tube be slotted lengthwise if a metal tube is used and the solenoid is to be operated on AC, in order to minimize any eddy current losses.

This switch can be located at any convenient place that will make the antenna lead as short and direct as possible. The control buttons are placed near the transmitter key at 2BQT. The transmitting key is located directly in front of the sounder and the control buttons to the right of the key. The rheostat and switch on the front edge of the table are in the 110V. AC leads

to the transmitter. By this arrangement the station can be operated from a seated position in front of the receiver or from a

For those who desire that the changeover switch turn on the power to the transmitter a third blade can be added between



position in an adjacent building where a second receiver and a second set of key, sounder, buttons, rheostat and switch is located.

the present two. For those who are not using the tuned counterpoise-ground system the second blade can be used for power or may be omitted.

Report on Receptions by British Amateurs in the Transatlantic Tests, December, 1921

By Philip R. Coursey, B.Sc., A.M.I.E.E.

Mr. Coursey is assistant editor of the "Wireless World" and the "Radio Review", England's leading radio periodicals, and, as our readers recall, was in charge of the arrangements on the other side in our A.R.R.L. Transatlantic Tests. In this interesting article he tells us the story of the tests from the viewpoint of the British amateur.—Editor.

FROM the British point of view the most striking feature of the recent Transatlantic Tests is the establishment of the fact that low power 200 meter signals have been heard over long ranges even with the limited aerial facilities allowed in Great Britain. For the first regular Transatlantic Test that was organized, i.e., in February, 1921, a remarkable amount of enthusiasm was shown, even by users of the simplest types of receiving apparatus, and the failure of those tests definitely to establish communication seriously damped the ardour of many for the second series of tests.

The failure of the first tests (February, 1921) I do not in any way attribute either to our listeners on this side, or to the apparatus they were using, but simply to the fact that the tests lasted only three nights. In the tests just completed, I think we have

conclusively shown that the transmission of the signals across the Atlantic cannot be relied upon to take place *every* night, as the atmospheric phenomena in the intervening space are too variable. Hence in the February tests lasting only three nights, the chances that anything would be heard were, as we see now, quite small—we should indeed have been very lucky if anything at all had been picked up on that occasion.

That being so, it may well be asked why signals from American amateurs have not been intercepted in this country before now. The reason, I think, is to be found in the five hours difference between our Greenwich Mean Time and your Eastern Standard Time (or the still greater difference between G.M.T. and the more western states), coupled with the fact that as a general rule, very very few of our men sit

up till the "wee sma' hours" of the morning unless there is something special to listen in for. Since no relay work or the transmission of ordinary form of messages between amateur stations is allowed in the British Isles, there is no inducement to listen-in over long periods, unless the incentive is provided by some special signals or tests, such as the recent ones.

If one may draw conclusions from the articles and comments published in QST and other American radio magazines, the opinion has been held apparently, by many in the United States, that the main reason why American amateurs' signals have not been previously heard in England is not that stated above, but rather due to the "inferiority" of British receiving apparatus, and statements have more than once been made to the effect that if we used "regenerative" receivers with variometer tuning all would be well. In this connection, one or two points may well be borne in mind; viz:—

1—Although given the same general principles, radio workers in different countries may develop apparatus along different lines, it by no means follows that the resultant products differing both in appearance and in mode of use, are necessarily in any way very different in effectiveness and efficiency.

2—The fundamental principle of "regeneration" is primarily that of feeding back amplified energy from the plate circuit of the tube to the grid circuit. This being so, the exact mode in which the feed-back is effected is not of first importance provided that it is capable of fine adjustment and its use does not interfere with the proper functioning of the receiver. Variometer tuning of the plate circuit provides a fine adjustment for getting the valve into the sub-oscillatory position which is so desirable for the reception of spark signals, the feed-back being mainly through the inter-electrode capacity of the tube plus any other stray coupling that may be present. "Reaction coupling" (as we generally call it) of the plate circuit back to the grid is a more positive way of accomplishing the same result especially when the reaction

(or "tickler") coil is tuned, in which condition we frequently use it.

3—Since all the pre-war British amateurs' radio apparatus was confiscated by the British Post Office during the war and removed into Government stores, the resumption of wireless activities after the war in nearly every case necessitated the building of new apparatus—the earlier apparatus when returned often not being in a fit state for use again. Naturally

then under these conditions C.W. apparatus is used almost exclusively, with the result that our present receiving apparatus is in most cases designed primarily for C.W. work—in which case the sub-oscillatory state of the tube is not required—since it must either be oscillating, for "audodyne" reception, or a separate heterodyne oscillator tube must be used. The former is naturally the method most favored by the average radio amateur. For this arrangement the tuning of the anode circuit is effected quite as easily with a fixed coil and a variable condenser as with a variometer, and in fact in some cases the former method has advantages.

4—The value of the tuned plate circuit is quite well recognized by most British amateurs and was employed by

the most successful receiving stations during the Tests, for the stages of radio frequency amplification used in front of the detector tube. Of course Mr. Godley as a visitor was granted more privileges than are normally allowed to the British amateur, who except in special cases is restricted to an aerial with a total amount of wire including down leads of not more than 140 feet, or 100 feet if only a single wire is used. Hence a companion of the ten or eleven stations heard by our amateurs on aerials of this size, with the twenty-three heard by Mr. Godley on his aerial of 850 feet is not so unfavorable, especially as only one Britisher used more than six valves all the time. It may here be of interest to note that 1BCG was read on a set consisting of two valves and a crystal detector by J. R. Forshaw of Omskirk near Liverpool.

To turn now to greater detail of the results—these are summarised in the cable-

1ARY Spark Heard in France

QST is in receipt of a letter from Dr. Pierre Corret, editor of the French amateur radio magazine "La T.S.F. Moderne", advising that one of their readers, Mr. G. Perroux, of Paris, on February 5th copied the signals of 1ARY, University of Vermont, Burlington, Vt., on their spark set.

Mr. Perroux used a single-wire antenna about 35 ft. long with a slanting lead-in about 55 ft. long. The tube equipment consisted of one valve as a regenerative detector and three valves as audio-frequency amplifiers.

It is most remarkable to contemplate the reception of spark signals in France on this simple equipment! Mr. Perroux agrees with us that it is an unquestioned freak. He came in on the end of a transmission just to hear "....ar 1ARY" and no further signals were received, but this much was copied without the slightest doubt as to the identity of the station.

Congratulations all around on another peach of a record—and spark this time!

gram which I sent to the A.R.R.L. in January and which read as follows:—

To Schnell Maxim Hartford Conn. USA. Eight British amateurs successful stop Following with correct codes one able fox vice two boy mike love two fox pup two zed love also one zed easy probable stop Following heard free periods one unit nan one ram unit one xray mike two zed cast probably two zed unit stop One boy cast George heard by five stations regret delay owing illness=Coursey

The following are the names of seven of those who picked up the signals, the eighth one referred to above preferring to remain anonymous (Mr. Godley can vouch for his existence, as they met during his stay in England):—

W. R. Burne, Springfield, Thorold Grove, Sale, Cheshire.

H. H. Whitfield, The Glen, Primrose Lane, Hall Green, Birmingham.

W. E. F. Corsham, 104 Harlesden Gardens, Willesden, London, NW10.

R. D. Spence, Craighead House, Huntly, Aberdeenshire.

A. E. Greenslade & E. W. McT. Reece, British School of Telegraphy, 179 Chapam Rd., London, SW9.

J. R. Forshaw, Westville, St. Helens Rd., Ormskirk, Near Liverpool.

T. Cutler, 24 Floating Bridge Rd., Southampton.

In judging the relative merits of those who heard the signals, preference was given to the correct reception of the special transmissions (during the period 9:30 p.m. to 1:00 a.m. Eastern Standard Time) with correct code words, etc., as this series of transmissions formed the most valuable means of verifying the correct reception of any particular American station. Reception of 1BCG during its special transmissions to Godley was on account of its more powerful nature not judged as of equal merit to the reception of an individual transmission with correct code word. Reception of stations sending "Test Test de

...", etc., on their correct time schedules, during the free-for-all period was judged next in order of merit, and finally the reception of other signals apparently of U.S.A. amateur origin during any period of the tests.

The table below sets out the number of stations heard in each of these classes:—

Name	Individual with correct Code	1BCG	Free For All	Other Stations
W. R. Burne	3			
Probably	4	1	2	—
H. H. Whitfield	2	1	—	—
W. E. F. Corsham	1	—	—	—
R. D. Spence	1	—	—	—
Greenslade & Reece	—	1	1	—
J. R. Forshaw	—	1	—	—
T. Cutler	—	—	1	1
Anon.	—	1	—	—
P. F. Godley	4	1	6	12

In the last line of the table I have added Mr. Godley's results, as taken from his log, for the purpose of comparison.

As a matter of interest the particulars of the number of valves used by the various receiving stations are set out below.

In most cases arrangements were installed for the use of a larger number of valves than shown in the table, if required, but the figures given represent those used when the American signals were heard.

The most obvious characteristic difference between the British sets and Godley's is in the more general use of radio frequency amplification in front of the detector valve, as distinct from the use of the Armstrong super-heterodyne arrangement immediately following the detector valve, or the more usual American amateur equipment of a detector tube followed by low frequency amplifying tubes.

It has often been said that efficient radio frequency amplification at wave lengths as short as 200 meters is not possible—and

Name	Total Valves	H.F. Valves	L.F. Valves	Separate Oscillators	Medium Fre- quency Valves	Detector Valves	Crystal Detector
W. R. Burne	5	3	0	1	0	1	0
	6	4	0	1	0	1	0
	9	5	1 or 2	1	0	1	0
H. H. Whitfield	6	2	2	1	0	1	0
W. E. F. Corsham	3	1	1	0	0	1	0
R. D. Spence	7	3	2	1	0	1	0
Greenslade & Reece	6	4	0	1	0	1	0
J. R. Forshaw	2	1	1	0	0	0	1
T. Cutler	3	0	2	0	0	1	0
Anon.	18	0	0	2	Armstrong Super.	2	0
P. F. Godley	10	0	1	2	Armstrong Super.	2	0

hence the importance of the Armstrong super-heterodyne arrangement—but I think the results obtained with the apparatus detailed in the above table is sufficient refutation of this idea.

In each of the above cases in which radio-frequency amplification of the short wave signals was used, it was effected by means of tuned "rejector" circuits in each

the autodyne method of reception with the whole set oscillating. The use of a separate heterodyne oscillator tends to reduce the interference which a receiving station may cause to others listening in the same neighborhood.

During the period of the tests signals were only heard during a few nights, and in this connection it is interesting to compare the reception made by the various listeners on different nights. These results together with those obtained by Mr. Godley are set out on the accompanying chart (Fig. 1), the number of stations heard being plotted vertically against the dates of the test horizontally. The number of stations heard by all the successful British amateurs have been added together and plotted as the full line on the chart, while the number of signals heard by Godley on each night is shown by the dotted line. In Fig. 2 is a second chart giving the total number of receptions complete with code words (plus 1BCG) made by the British amateurs (full line) and by Godley (dotted line). In these curves Godley's unverified reception of 1AAW on the 8th has been omitted, the other figures for his reception being taken from his reports sent from Carnarvon.

In both these charts the date against which the figures are plotted is that of the morning (Greenwich Mean Time) on which the signals were heard.

Although 1BCG was the first U.S. station definitely heard by Godley (in the early morning of the 10th of December) the first station heard by a British ama-

anode connection ("tuned-anode" coupling, as we generally term it), since this method is both theoretically and practically the most effective especially for short wave lengths. This is the case mainly because this method of interval coupling makes effective use of the internal or inter-electrode capacity of the valve itself which would otherwise produce a loss of amplification at high frequencies. Variometer interval couplings could also be utilized for a similar purpose, but for most purposes for C.W. reception tuning of the circuit with a small variable condenser and a fixed inductance proves the more useful of the two. One difficulty often encountered in the use of the tuned interval coupling is the great tendency that the whole set has to self-oscillation. This tendency in practice is controlled either by means of a potentiometer arranged to put a positive potential upon the grids of one or more of the radio frequency amplifying tubes, or by a magnetic reaction coil coupled in the reverse direction to normal so as to oppose the production of sustained oscillations.

Sets of this type can of course be used in the oscillating condition for "autodyne" (beat) reception, or a separate heterodyne oscillator can be employed. The latter was preferred (as indicated by the above table in the column headed "Separate Oscillators", but three of the successful amateurs used

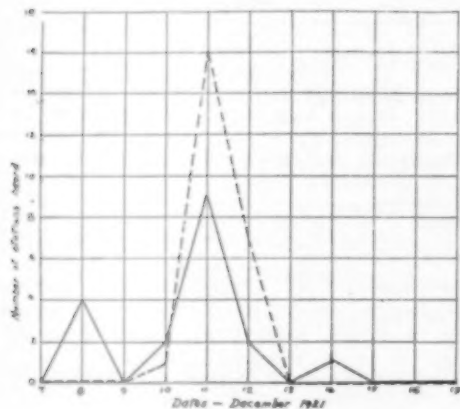


Fig. 1—Chart of Reception of Signals. Full line, total British receptions. Dash line, Godley's receptions.

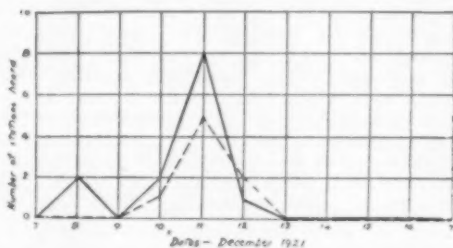


Fig. 2—Chart of Reception of "Individual Transmissions" complete with code words—plus 1BCG. Full line, total British receptions. Dash line, Godley's receptions.

teur was 2FP, whose signals were picked up at 2:30 a.m. (G.M.T.) on December 8th. It may also be noted that signals from 2ZL (J. O. Smith, Long Island) were heard by all of the first three of the prize-winners amongst the Britishers but were not heard by Godley.

A study of the weather conditions over the Atlantic during the period of the tests does not obviously show any marked feature such as would lead one to suspect the greatly improved transmission on the

night of the 10th and 11th December. The most noteworthy thing about that night was that along the great-circle line between the Eastern States and England (i.e., along the line followed by the signals) there was a somewhat more marked "saw" of barometric pressure than occurred at other times. This marked pressure disturbance immediately preceded a severe storm in the Atlantic—the storm in which the "Olympic" and other vessels fared somewhat badly, as reported in the daily press of that date. On most other nights the pressure changes along the great circle line were somewhat more gradual, and often the signal track passed for long distances over places at very nearly the same barometric pressure.

It is to be hoped that further tests such as have already been arranged on a small scale between individual stations in the two countries may be made on an extensive scale and may lead to the collection of valuable information on the why and the wherefore of long distance short wave signalling, as well as encouraging amateur communications between the two countries. Possibly even at some future date radio amateurs in this country may be permitted to transmit messages in reply—but in the meantime may every enthusiastic U.S. radio amateur experiment with radio frequency amplifiers and try to hear our 10 watt transmissions from this side of the Atlantic!

The Importance of Higher Voltages for Amateur Spark Communication

By S. Kruse and D. W. Richardson

SUMMARY—It has been demonstrated in practice that higher voltages and lower spark pitches are superior for spark radio communication using 60 cycle supply. An attempt is made to explain this, without contradicting the frequency demands of the telephone headset which are usually regarded as demanding 1000 sparks per second.

Attention is called to the fact that while a synchronous gap producing one spark per half cycle permits the use of the peak value of the transformer secondary voltage any higher spark frequency tends toward the condition where the spark voltage becomes one half of the peak value.

The conclusion is reached that if proper insulation precautions are taken the most effective spark transmitter for low wave work will be one using a 60 cycle synchronous spark gap and a transformer with a 28,300 volt secondary, whose peak value is 40,000 volts.

THE entire purpose of a sending and receiving set is to produce on the grid of the receiving tube such changes of potential as to produce audible signals in the phones that are connected into the plate circuit.

Each incoming wave train has to change the grid potential by the required amount, for between trains it resumes its non-operating potential automatically.

For the sake of simplicity we will assume that a single-circuit receiver (Fig. 1) is being used. The circuit consisting of the antenna, the condenser C_1 , and the coil L_1 is tuned to the incoming wave.

The current that is set up in the receiving antenna circuit passes thru the coil L_1 and in so doing produces across it a small voltage. That voltage immediately appears on the grid which is connected to the coil and if the voltage was large enough an audible change in the plate current will follow.

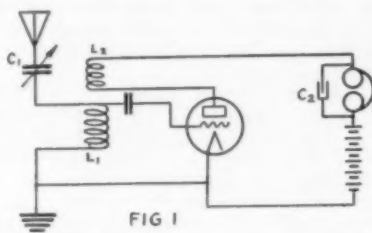
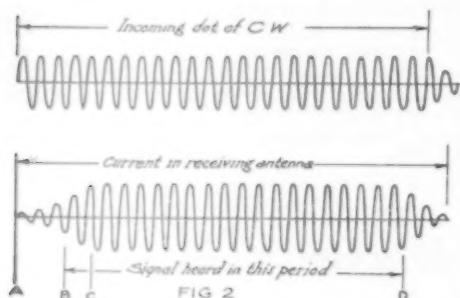


FIG 1

If the incoming wave train is a C.W. train we can represent the procedure rather crudely as in Figure 2. From A to C the current in the receiving antenna (the so-called "received current") is being built up until at C it becomes steady and remains steady as long as the sending operator keeps his key down. When he releases it the current in his sending antenna dies down, the outgoing wave train tapers off and the "received current" does likewise. But during the period B to D the received current is strong enough to produce an audible signal. It is accordingly possible to build up fairly high detector voltages (as such things go) from a very weak incoming C.W. wave train. The essential thing is that the arriving train be really C.W. and not "crippled C.W." with buzzer

notes, phonograph music, 60 cycle plate supply or rectifier noises superimposed.

The case changes when the incoming signal is one generated by a spark set. In the rather exaggerated Figure 3 it at once becomes apparent that the process of building up gradually a current in the receiving antenna cannot be much used. Each



wave train lasts such a short time that the process has hardly begun before the incoming energy begins to diminish. Here the first few oscillations of the train carry most of the energy and are depended upon to operate the detector without any aid from the later oscillations of the train. It seems reasonable, therefore, that the greatest range will be obtained with the type of set that produces the highest peak values of current in the receiving antenna during the first few oscillations of each wave train. That in turn means the set which will produce the most energetic condenser discharges.

In the short-wave field the condenser capacity is limited by the wave length and in the amateur field the total power input is also limited. The only remaining method of increasing the energy per discharge is to use a lower spark rate and increase the energy per spark by charging the condenser to a higher voltage.

The use of higher voltages and lower spark rates has already given a good account of itself in work below 600 meters. There has even grown up a suspicion lately that such a set is not only superior to a higher pitched non-synchronous set with 60 cycle supply but possibly it is also superior to sets using 500 cycle supply. Many coastal and ship sets of one or two kilowatt rating, using a secondary voltage of 10,000 to charge the condenser, have in the last few years been replaced by 500 cycle quenched gap sets of higher power. The new sets have rather uniformly failed to carry as far as the others, even the better receivers are now used. This is unfortunately evident throughout the tropics where

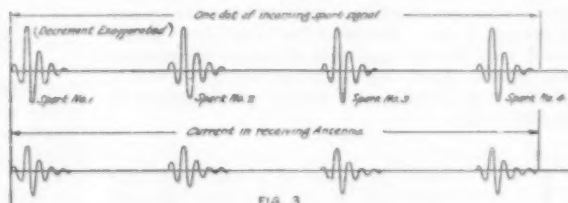
new 500 cycle sets have been installed. And on the Atlantic coast it is interesting to note that the station with the longest range was old "WLC" which did not use a 500 cycle set and was lower powered than nearly all other stations in the vicinity.

It is more than probable that this is due to the sad fact that the American operator and the American quenched gap set seldom agree well enough to produce that good quenching, sharp wave and clear note which should be produced. It is unfair to blame a system for faults that belong to the operator and the individual set. The argument accordingly will be confined strictly to amateur conditions—60 cycle supply.

In the amateur field we deal normally with 60 cycle supply and the argument is simplified into that of determining the proper spark frequency to be used with that supply frequency. Among regular amateur stations the notable spark stations such as 2RK, 2FP, 3CC, 8ML use 30,000 volt sources and their close competitors use 25,000 volts or thereabouts. The same holds true among the specials 3XM, 6ZK, 9ZN, 9ZL, etc.

The tones of all the stations listed are low, in other words they are all operated on the principle given above that each condenser discharge should be as energetic as possible so that the voltage placed on the grid of the receiving tube by the first few oscillations of each wave train may be as high as possible.

Lest anyone still be worried about the fact that tube sets with low sending antenna voltages carry very well we will repeat—the object is to produce voltage on the receiving tube grid. Whether we supply the necessary energy to the receiving antenna in an abrupt wave train or by gradually building it up with the aid of a thin trickle of incoming C.W. does not matter;



we must in some fashion obtain the needed voltage. With the C.W. the voltage rise in the receiving antenna will continue until the resistance losses in the receiving system use up energy at just the same rate at which it is arriving. Before that happens we may have built up from the little stream of energy that some 5 watt tube is sending us a "received voltage" that may compare very favorably with the voltage which a spark in a half kilowatt set at the same distance could send us "all in one

lump". If we use a spark we must of necessity send our energy in more or less impact form; hence the effectiveness of the tube sending set only strengthens our argument that the energy in each spark train should be as high as possible.

Thru the last five years the tendency in amateur work has been steadily toward lower spark pitches and correspondingly higher voltages. Usually the idea has not been carried far enough and it is to be hoped that (if the spark set will continue

The classical argument opposed to the high-voltage low-tone set is that telephone and ear efficiency increase greatly at higher pitches. Now it is not at all easy to prove the former statement for anything but sine wave currents and the tone of a 60 cycle spark set is decidedly not a sine shaped sound wave.

With impact excitation of the diaphragm we no longer obtain a sending curve with a single sharp peak near 1000 cycles. Increased ear efficiency at 1000 cycles cannot be denied but the low-tone, high-voltage spark signal has a great compensating advantage; it can be strengthened very much more by regeneration at the receiver before the tone "breaks". This in a very large measure accounts for the strong signals that can be secured. The ability to regenerate more brings with it still another advantage; namely, that sharpness of tuning is improved and interference much diminished thereby.

So far we have argued on the basis that with a certain amount of power available it was an advantage to use that power in comparatively few sparks. It is now interesting to take up the matter of the voltage needed to put a full kilowatt into a small number of sparks.

We cannot use over .01 microfarads capacity in the closed circuit if we are to work it on 200 meters unless we resort to freakish constructions and even then are able to exceed this capacity very little. Into that small capacity at a low spark rate we are to put 1000 watts.

The energy in a charged condenser is

$$J = \frac{1}{2} CV^2$$

where J = joules of electrical energy

C is the condenser capacity in microfarads

V is the condenser voltage in kilovolts

This is the energy in the charged condenser and if there are N sparks per second we must put into the system N times this many joules of energy during each second. In other words the rate at which energy is supplied, which rate we call the watts input, is

$$W = \frac{C(V^2)N}{2} \dots \dots \dots (\text{Formula No. 1.})$$

where N is the number of sparks per second as above.

Solving for V this becomes

$$V = \sqrt{\frac{2W}{CN}} \dots \dots \dots (\text{Formula No. 2.})$$

We are not yet quite ready to calculate the voltage required to put 1000 watts into a .01 condenser at various spark rates as

When one spark per half cycle at 90° and 270° or 120 sparks (4 tooth synchronous)
 $E = \text{peak} = R.M.S. \sqrt{2}$
 Suppose we talk about a 20,000 volt Transformer
 $E = 20,000 \sqrt{2} = 40,000 \text{ volts}$

(A)

When two sparks per half cycle at 45° 135° 225° 315° or 240 sparks (8 tooth synchronous)
 $E = \text{peak (sine 45°)}$
 $= R.M.S. \sqrt{2} (.707)$
 $= (20,000)(.707)$
 $= 14,140 \text{ volts}$
 i.e. = R.M.S. voltage or 20,000

(B)

When large number of sparks used
 If number is near 1000 the spark voltage hits (this is experimental) near $\frac{1}{2}$ the peak value
 $E = \frac{20,000 (\sqrt{2})}{2}$
 $= 19,796 \text{ volts}$

(C)

FIG. 4

and not be driven out by the tube) the progress will be continued in the same direction.

The low tone also seems to have the peculiar property that we refer to variously as the ability to "carry", to "get out" and to "break thru"; in other words it seems to be gifted with an ability to give consistent performance thru adverse weathers and at all times to outrange the higher tones tho the latter may locally be far louder. A little thot by anyone in the amateur operating game will confirm this; it is only necessary to list the long distance stations that are heard regularly as clockwork while others come and go.

As specific example there may serve station 9ZN. The 240-spark set is steady and very loud. When the operator at 9ZN can be persuaded to move the synchronizing arm on the gap so as to produce 1 spark per half cycle or 120 sparks per second the current in the sending antenna drops but the signals received on the east coast increase very greatly.

we are still hazy on the proper value of V to be used in Formula No. 1.

The voltage of a transformer or an alternating current line is given by stating its r.m.s. or "root mean square" value. As most commercial line supplies are more or less of sine wave form the highest voltage during the cycle which we call the "peak" voltage is the r.m.s. voltage times the square root of 2—i.e.,

Peak vltg. = r.m.s. volts $\sqrt{2}$. (Formula No. 3.)

In Figure 4 are sketched the voltage waves of a 28,300 volt transformer which is being used at various spark rates in a, b and c.

Beginning with Fig. 4a we are using 4-point synchronous disc running 1800 r.p.m. and giving one spark at the peak of each cycle where the "X" appears. The voltage on the condenser is evidently (Formula No. 3)

$$28,300\sqrt{2} \text{ or } 40,000 \text{ volts.}$$

Now let us see what amount of energy the condenser circuit is taking by using Formula No. 1.

We have one spark per half cycle, hence 120 per second and $N=120$. We have also just stated that $V=40$. C is .01 as before.

$$W = \frac{CV^2N}{2} = \frac{(.01)40^2(120)}{2} = 960 \text{ watts}$$

Hence this is a "genuine one kilowatt set" with a large "punch" per spark.

Next in Figure 4b we have an 8-point synchronous wheel giving 2 sparks per half cycle as shown. At the points marked the voltage is the peak voltage times the sine of 45 degrees which is .707. Then our spark voltage is 40,000 times .707 or 28,280 volts. Again we will calculate the energy input to the set. We have 2 sparks per half cycle or 240 per second and $N=240$, V equals 28.2, C is still .01.

$$W = \frac{CV^2N}{2} = \frac{.01(28.2)^2(240)}{2} = 948 \text{ watts}$$

This too is a "genuine one kilowatt set" but we do not have the same energy per spark, hence will not produce quite the same effect at the receiving set grid. We are forced to hope that an increase in readability of the tone will compensate for this.

At spark rates above 240 per second we can no longer maintain a synchronous tone as there are only two points in a half cycle where the voltage is the same. It is possible to operate a 12-point wheel synchronously but the resulting tone is anything but pleasant as was demonstrated to all of us to repletion last winter by a number of stations which made the attempt.

To raise the pitch any more we must go to non-synchronous operation. In order to secure a good tone it is necessary to go a little ways above 240 sparks and the

usual spark frequencies heard at amateur stations seem to lie between 360 and 600 sparks per second. It is no longer possible to give a definite value of spark voltage for this condition of operation but toward the upper end of the band of tones named the value of the spark voltage is not far from half the peak value. In Figure 4c we are operating non-synchronous at 620 sparks per second or somewhere near 10 sparks per cycle. The spark voltages no longer lie along the sine wave form but all have about the same value which for this frequency and 60 cycle supply is about half the peak value.

The fact that all sparks have about the same initial voltage value can be proven by Braun tube oscillograms but a much simpler way is to watch the spark gap by its own light. If it is well built, the wheel will appear so perfectly stationary that it is hard to believe that it is really running.

Again let us calculate the input energy. We now have 620 sparks per second and $N=620$, V has become half the peak or 20 kilovolts, C remains .01 microfarads.

$$W = \frac{C(V^2)N}{2} = \frac{.01(20)^2(620)}{2} = 1240 \text{ watts}$$

The input to the set is higher than ever before and the antenna current will be larger than in either of the previous cases. We can however say confidently that the range will be much less, the experience of several thousand experimental stations during five years assuring us that we will be correct.

The explanation is as before the fact that the energy per discharge is less. And we are convinced that the important thing is the energy per discharge and not at all the wattage consumed by the set, or the wattage in the antenna.

The advantage of the low tone has been insistently harped upon but it must not be supposed that merely lowering the tone will create a good set from a poor one. Let us consider a poorly designed set, for instance,

Transformer voltage 18,000—rated at 1 kilowatt

Condenser .005 microfarads

Gap—synchronous 8-point at 1800 r.p.m. or 240 sparks per second.

This set is like case 4b—it will draw 195 watts. This set is out of proportion, probably arcs badly at the gap, and certainly is a failure as a one kilowatt set. The simplest improvement would be to double the condenser capacity and so increase the input to 369 watts. By speeding up the gap the input to the set and also the antenna current can be increased still further but the energy per spark promptly begins to diminish and the range of the set will almost certainly decrease instead of rising. The set is simply a rather hope-

less thing because the transformer voltage is too low. If however the owner is curious and wishes to use a kilowatt regardless of results he may calculate the required spark rate (approximately) from case 4c:

At the higher spark rates the spark voltage becomes about $\frac{1}{2}$ peak or for this case

$$\frac{18,000\sqrt{2}}{2} = 12,700 \text{ volts.}$$

Solving equation No. 1 for N we have

$$N = \frac{2W}{CV^2} = \frac{2(1000)}{.01(12.7)^2} = 1240 \text{ sparks per second.}$$

This will give a kilowatt input, but, as stated above, probably damage rather than aid the range.

By way of contrast consider 2RK, Mr. Hewitt's well known station. Here a 30,000 volt transformer charged a .01 condenser which discharged thru a synchronous gap at 240 sparks per second as in case 4b.

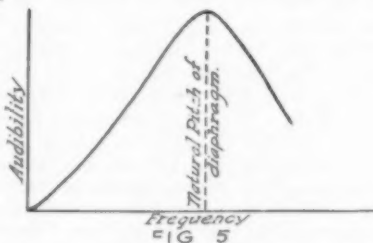
The spark voltage is sine 45 (30,000) $\sqrt{2}$ or 29,694 volts.

The wattage is

$$W = \frac{.01(29.69)^2 240}{2} = \text{or } 1080 \text{ watts.}$$

Here then is another "genuine one kilowatt set" with its energy in a small number of strong wave trains. According to our line of reasoning and according to our experience with 9ZN the range could be increased still further by dropping to one spark per half cycle and charging the condenser to the peak value of 42,000 volts.

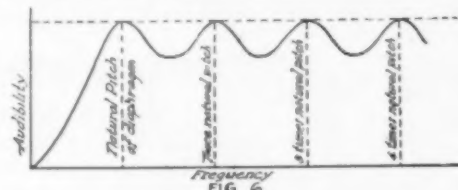
Evidently this thing requires a high voltage transformer. If none is at hand two half kilowatt transformers with 15,000 volts secondaries can be used, the secondaries being put in series and the primaries in parallel. This had better not be tried unless the secondary of each transformer consists of a single coil so that the high voltage ends can be kept away from the core.



In all of the foregoing we have blandly assumed that the headset pitch-efficiency was a thing that did not count under our operating conditions. We excused that assumption by making still another assumption, namely, that our spark signals amounted to "impact excitation", one im-

pact per spark. Now that was a false assumption and was made for the sake of avoiding a trip off to one side until later. Let us get this matter straightened out now—to the best of our ability.

If the combination of headset and ears is tested for sensitivity at different frequencies, using sine wave current we will undeniably get a nice high peak at some point near 1000 or 1500 cycles—somewhat like the rough curve of Fig. 5 where the dotted line is at the natural frequency of the diaphragm. The man who is receiving a flute-like C.W. note or a fine clear quenched spark note is quite right in demanding that the pitch be placed on this peak.



If we could devise a signal that would really give a single impact to the phone diaphragm at each spark we would expect a sensitivity curve somewhat like the one of Fig. 6. It is fairly obvious that the sensitivity for impact excitation ought to be greater at the natural frequency, twice the natural, etc., than it is at points between. It is not quite so obvious that all of these peaks will be about the same height and almost as tall as the one peak we got with sine wave current. That is roughly correct, however.

Now the real importance of all this to us is that the part of the curve from zero up to the first peak is not very terribly different from the curve we got for sine wave currents. So it is a fairly safe guess that our sparks will follow the same curve because their tone quality is something between a clear flute note and a rattle.

All of this looks very much as if we were proving all over again that our spark must be at 1000 cycles. But wait a moment! We just spoke of the "tone-quality" of our sparks. What is meant by that? Simply this, the pitch or frequency of a sound is not the only thing we use to recognize a sound. A cello and a brass horn can play the same note without sounding at all alike, one can even tell with certainty whether a whistle is being blown by steam or compressed air. The reason is that while the fundamental pitch is the same there is a great difference in the intensities of the various higher tone frequencies that trail along with the fundamental pitch. Some of the higher tone frequencies are regular harmonics, 2, 3, 4, 5, 6, 7, etc. times the fundamental tone while others do not "belong to the system" at all. That is why 1AW and 9LQ never sounded alike, even

tho their pitch was identical, that is why the old non-synchronous gap at 9ZJ was individual and 9LR's peculiar wail could be recognized at once. Others were using the same number of sparks per second as 1AW, the fundamental note was the same, but some of the higher frequencies that went to make up the note were missing or were there in different proportions.

All this seems to be badly off the subject of correct spark frequency. It is not. Suppose we had a 150 cycle note that had a strong third harmonic and a very strong 7th harmonic. Perhaps the 7th even carries most of the energy and the fundamental much less. Now 7 times 150 is 1050 cycles. So we thought that we had our noise at 150 cycles but most of it is really at 1050, right on our best phone sensitivity.

Now that is a violent example. No tone is as simple as all that. But it illustrates the sort of note quality we actually get from our 60 cycle rotary gaps, notes in which most of the sound energy is on frequencies considerably above the spark frequency.

It now becomes fairly apparent that if we put the spark frequency up to 1000 (assuming our note quality did not change) we would push the higher frequencies that carry our sound energy away up on an insensitive part of the phone curve where it would do no good. Of course we now have the spark frequency itself on the sensitive point of the phones but as we said before that apparently carries little energy.

Now there were high pitched non-synchronous sparks that did carry well, such as 8BO and 8ZL. These we must explain by saying that they either accidentally had most of their sound energy on the fundamental note frequency or else we must claim that we are operating on the impact curve (Fig. 6) and their best sound harmonic has hit on one of the higher frequency humps on this curve.

In general this does not seem to happen and whether we accept the idea of semi-impact building up of received voltages or find it more reasonable to explain matters on the basis of sound quality—in either

case the fact to which we have tried to fit these theories remains—the low pitched 60 cycle sparks outdo the higher ones, in both maximum range and consistency of range.

And with this they carry greater ability to “stand more regeneration” before losing their tone and “mushing”.

In summing up, then, we are convinced that the most effective type of amateur spark set now available consists of the following—a transformer with a voltage of 30,000 r.m.s., a condenser of .01 microfarad capacity, and rotary gap which is a four-point disk driven synchronously so as to discharge once at the peak of each alternation.

Not all of us can use just such a set, otherwise we will all have notes exactly alike and interference will be hopelessly bad. We can however make use of the simple fact that the way to use our limited power most effectively is to use a very low spark rate and raise the transformer voltage to whatever value is needed to put 1000 watts into the condenser.

There are also practical operating difficulties in the way of installing a high voltage set. The stresses on the condenser and the transformer itself are very severe and both these devices must be of the very best. The

gap also becomes tremendously noisy and must be muffled most carefully.

And finally the high field intensity produced by the higher antenna voltages will cause a considerable increase in the induction of high frequency voltages in power wires nearby. There is no sense in waiting for trouble to develop. One should, before operating the set at all, take the precautions that were listed in our Advisory Technical Committee article in the November 1921 QST under the title “The Protection of Near-by Wiring Against Troubles Caused by Spark Transmitters.”

The type of set we have is described is then thoroly safe and ready to convince the most skeptical that it can consistently out-range other spark sets.

Hawaiian Relay Established

Recently we have discussed the possibilities of relaying between the Pacific Coast and the Hawaiian Islands, particularly via the new transmitter of 6ZAC, C. J. Dow, Maui. Now it is our pleasurable duty to record the establishment of actual relay communication over this great jump. On Thursday, April 13th, 6ZAC was reliably in touch with the mainland, and on that and the succeeding night A.R.R.L. relay traffic was exchanged by him with 6ZQ and 6ZAF, the latter two on the coast. At this writing communication is being had daily on schedule. Now for that relay from Honolulu to The Hague! But first, all hail another rousing amateur accomplishment!

EDITORIALS

de AMERICAN RADIO RELAY LEAGUE



The Wild Wild Waves

WHAT is happening to our grand old game of Amateur Radio? It is with mingled pride and sorrow that today we view what once was our closed sport—pride that it is now such a stupendous thing in the life of the country yet sorrow that its expansion should be as feverish and hectic, as unhealthy and abnormal, as it is.

It's a wild wild game—just one mad scramble. It started last fall when broadcasting was first initiated by the big companies, and, primed by all the post-war publicity radio has been given, the public was ready for it. Everybody promptly went bugs on wireless and gobbled up all the apparatus in sight. The demand was perfectly enormous, the factories doubled production, new companies started, and still not a dent could be made in the orders. Then things started in earnest. Hundreds of new companies, good, bad and indifferent, are now dumping apparatus on the market as fast as they can grind it out and every single little bit of it is being eagerly soaked up by a wild, wild public. The only comparison we can think of to the boom in popular radio is the rush to the Texas oil fields! There is money to be made in radio, and in particular in this period when "hard times" are the rule in other businesses we see everybody who has a ghost of a show trying to break into radio. There're a dozen new radio magazines; every big newspaper in the country has its radio department in charge of an "expert" many of whom simply "aint"; all the new apartment houses are being wired for radio reception; the movies are full of it; the photograph agencies dump great piles of radio pictures upon us, many of which are decorated with feminine legs, always a sign of popular interest; the phenomenal success of the New York show started scores of promoters to buzzing and now there are as many radio exhibits planned as there are idle promoters; we are besieged by "circulation builders" and "efficiency experts"—and so it goes. Newsboys are stealing the receivers from public telephones and peddling them in cities where radio headsets cannot be obtained for love nor money; profiteering is engaged in frankly and tubes can't be obtained even if one is willing to pay a premium to the

bandit behind the counter; gorgeous radio receivers in handsome console trimmings are selling for hundreds of dollars. Hundreds of our brother amateurs have deserted their amateur status and embarked in the commercial world, sometimes at handsome salaries, sometimes as the pilots of their own businesses. There're yells from the folks who are being hurt too—the theatres complain that folks stay home and listen to broadcasts instead of patronizing them; the phonograph people are up in arms because nobody buys records any more; and the Associated Press, we understand, has threatened its members with instant expulsion if any of them make use of "A.P. news" for radio broadcasting—these little things contributing to the general confusion. Governmental committees plan new radio legislation, big cities contemplate owning their own broadcasting establishments, insurance folks revise their radio installation codes; all the department stores put in popular lines of apparatus. The newspaper cartoonists sketch it, the sob-sisters write about it, current literature is filled with it—everything is radio. And our own little amateur world—we have our own share of excitement, what with Transatlantics, Transpacifics, international amateur radio possibilities, governors-president and police chiefs relays, the startling successes of low-powered C.W. transmission every night.

Now where do we amateurs get off?—what does all of this confusion mean to us? What's going to happen to the old game and where will we be a year from now? We're losing good men from Amateur Radio—perfectly good fellows going mad over the chase of the Almighty Dollar. Is this all a vast bubble? Frankly, we'd give a lot to know. As we look at it, the attitude with which Mr. Average Citizen enters popular radio does not justify calling it more than a fad, a transient fancy, on his part. He will do one of two things: lose interest and quit in a relatively short length of time or become a regular ham with the rest of us. Meanwhile there are a few million more people to supply with apparatus and the wild rush continues. Judging by the perfectly enormous plans on foot to turn out apparatus in prodigious quantities within the next few weeks, we would say that next fall should see the supply equal-

ling the demand, the hot air going down out of things, and the entrance upon the period of reconstruction in the Citizen Radio business. Competition will again be evident, there'll be business failures a plenty and again the survival of the fittest. The first hectic flush will be passed, the broadcast programs will be improved and co-ordinated, ethical standards will be established in the trade, new legislation should be in force, and Private Radio should settle down in its rightful place as an indispensable servant of the great American public.

Meanwhile amateur radio grows. The public are becoming interested in amateur radio! They talk amateur stuff, they use the ham dialect; cartoons in New York papers during the big show there showed the real amateur spirit, and by the way that show helped wonderfully to heal the breach between the old-time amateur and the novice listener. It was the same old story—they met each other, got an understanding of each other's viewpoints, and the difficulties started disappearing. Just like T.O.M. prophesied, the "dah-dit-dah" stuff is proving its fascination and one by one they are attaining citizenship in the empire of the American Ham.

Fellows, amateur radio is one thing that can't be commercialized. Ever bear in mind the difference between our real amateur work and the present commercialization of popular listening. They're as different as spark and C.W. We amateurs are going our unperturbed way, adjusting ourselves to the presence of a million new-comers, ready to extend a helping hand to welcome and instruct a new brother in the use of our working tools, but keeping our game clean and fine and non-commercial. Our A.R.R.L. is experiencing a fine and healthy growth in membership, real men who have been attracted to us by the things for which we stand. The circulation of our QST is now close to the fifty-thousand mark and growing all the time. This growth has not been obtained by a fleet of professional membership-solicitors nor by dumping huge quantities of the printed magazines upon the newstands. That would not be a healthy growth for the novice listener is not always ready for the A.R.R.L. nor can our QST, primarily devoted to the practical improvement of short-wave communication, hope to be of much service to him until he progresses a little. That growth represents an increase in the ranks of real Amateur Radio and every bit of it has been voluntarily sought. Bite by bite the little wireless bug gets in his deadly work and then we can help—in the graduation of a Novice into a real Amateur.

Meanwhile let us take care to preserve our fine A.R.R.L. spirit. Let us not grow too excited about the possibilities of making

money out of our amateur knowledge. Every one of us should bear in mind the clean foundation upon which the A.R.R.L. is reared, hold it sacred, preach it to the new men. What a glorious thing the non-commercial nature and true clannishness of our A.R.R.L. is in these hectic days! It is a marvel that there could be an organization of the real amateur, owned and governed by him in his own interest. Spread the glad tidings, for we never had a more splendid chance to help our organization. Just such men as we want are waiting without the portal, worthy and well qualified and desirous of obtaining entrance in such a fraternity as ours. Welcome them in!

And help us to keep Amateur Radio clean!

Measurements

DID you ever sit down and think just how we amateurs generally go at a thing? It seems as though at times Lady Luck is an interested visitor and then again everything goes wrong. Our biggest fault is going at things blindfolded—by "rule o' thumb." The measurements in our work are easy to make with sufficient accuracy for our practical purposes, yet there isn't one fellow in a hundred who can tell you what his antenna capacity is, let alone resistance, inductance and other fundamental things that he should know.

We sometimes think there are a lot of queer things happening in our work, but do we ever stop to think that there is a reason for every one of them? In many cases fundamental measurements that any amateur can make will account for the things we think are queer. Someone has said that good guessing is a fine art, and that hits us pretty hard. Some of us may be artists in guessing or make ourselves think we are, but we could spend that time actually making these measurements and then we would know positively what's going on. For instance, at a certain station one man guessed his antenna resistance to be around twenty ohms, basing his guess on the outputs of his transmitters or what he thought they were. It was another case of queer doings and finally after several years of talking about it he made the measurement and found the resistance to be only three ohms! And it took only fifteen minutes to make the measurement!

We can't hope to tell why the other fellow gets out and we don't by guessing, but we have an excellent chance of putting our finger on the exact reason if we find out just a little about what is going on about us. Moral: make measurements.

The Operating Department

F. H. SCHNELL, Traffic Manager
1045 Main St., Hartford, Conn.



AT this writing the entire Operating Department is being overhauled and will break forth all polished and ready for real business before fall. The old scars and dents will be sandpapered away and we will have the smoothest running machine ever known in the history of amateur radio. We are in the midst of the greatest scene of activity since the inception of the League. Probably the reason for it all can be attributed to broadcasting, but a great deal of it can be resolved down to the fact that the spark is passing away more rapidly and CW is coming into use nationally. Be that as

Why in thunder do amateurs accept messages and then never deliver them? Where is the sport in doing a thing like that? Rather than accept a message which you have no intention of delivering tell the transmitting operator that you don't care to handle traffic. If you accept a message, **DELIVER** it!

Bert S. Brown, 9UH
647 messages.
Clifton, Ky.
Central Division.

Message Traffic Report By Division

Division	C.W.			SPARK			TOTAL		
	Stns.	Mgs.	M.P.S.	Stns.	Mgs.	M. S.	Stns.	Mgs.	M.P.S.
Atlantic	29	1886	65	14	779	55	43	2656	59
Central	26	1387	52	54	5488	102	*25	*7194	84
Dakota	9	345	59	13	1321	102	22	1666	93
Delta	3	70	23	5	264	55	8	334	42
East Gulf	18	1619	90	13	518	40	31	2137	69
Midwest	7	459	66	13	1393	107	20	1852	92
New England	3	295	98	12	959	80	15	1254	84
Northwestern	2	50	25	17	702	41	19	752	40
Ontario	2	35	18	5	85	17	7	120	17
Pacific	3	43	14	7	695	99	10	738	74
Roanoke	20	261	13	22	334	17	42	595	14
Rocky Mtn.	8	659	82	9	490	55	17	1149	68
West Gulf	3	282	94	8	1040	130	11	1322	120
Winnipeg	1	27	27	0	0	0	1	27	27
	134	7418	48	192	14059	73	331	*21796	66

*Includes 5 stations and 319 messages not designated as to type of transmitters.

Total Spark—14059—66%

Total C.W.—7418—34%

it may, we have reached the point where we must prepare for bigger things—greater things that will come to pass before the next two years go by. We must establish Transatlantic Amateur Radio Traffic with England, France, and Holland. We must run a relay from Honolulu to the above countries. We are just waiting for our good friend C. J. Dow, who has made a name for himself by copying signals from every district while in Honolulu, to get his transmitter percolating and we shall arrange the relay mentioned previously. Those are things which we must keep in mind.

Individual honors this month go to the Central Division.

Your attention is invited to the individual message reports which appear under each division report. From that you can get an idea of what is being done by amateurs in other divisions. These figures make up the message traffic report which follows.

Every League Member is requested to notify his division manager of the number of messages handled each month, designating whether handled on spark or CW.

Following are the reports from the various Divisions thruout the League:

NEW ENGLAND DIVISION

P. F. Robinson, Mgr.

Station Call	Msgs. Handled	Spark	C.W.
1BDV	—	—	45
1BJE	114	—	—
1BZN	71	—	—
1CK	6	—	34
1CNI	68	—	—
1CZ	75	—	—
1DY	3	—	—
1LZ	105	—	—
1RX	108	—	—
1SN	223	—	—
1UN	—	—	5
1WQ	135	—	—
1PR	10	—	—
1BKQ	—	—	173
1AKB	—	—	38
1COA	41	—	—
Totals	959	—	295

3NB	46	2ACD	15
3LR	42	3GZ	7
2AQU	42	2DX	6
2AJF	37	2ALN	5
3FP	36		
3EM	33	Total	770
3FS	28		
2OF	28		
2BQA	25		
2AZZ	22		
3BG	18		
3AS	16		
3KM	15		
8ARI	13		
3AFU	10		
3SQ	10		
3BUR	7		
3JJ	4		
3IL	4		
Total	1886		

QUEBEC DIVISION

A. J. Lorimer

The Division Manager breaks silence with a report. His scribble was omitted during a spell of sickness.

Here as elsewhere we have the phone "listeners" problem on our hands. The remedy has been quiet hours 8 to 10 p.m., as approved by the Montreal Radio Assn.

Recommendations have been handed to Ottawa, Dept. of Naval Service, for the suppression of spark transmission by amateurs during the quiet hours. C.W. transmitters are to be exempt.

Traffic can still be handled after quiet hours, but until matters are straightened out no stations keep schedules for traffic. However, 2BG of Longuenil still works through with his little ten watt set and is our best outlet at present. 2AN of Montreal has put in C.W. and has handled some traffic. 2DN, 2AF and 2AM are also looking after C.W. transmission.

Among the sparks 2BE, 2AL and 2EI are getting out well. 2CI at Farnham has had to drop DX work on account of induction troubles in that vicinity.

ATLANTIC DIVISION

C. H. Stewart, Mgr.

C.W.		SPARK	
Stn.	No. Msgs.	Stn.	No. Msgs.
3ZY	345	2DI	288
3ZO	311	2OM	208
3ALN	148	2ALY	60
8BRL	138	3FB	40
3FM	130	2BDG	32
8XE	128	2AAF	31
3BA	79	2BXY	26
3AJD	63	2AXA	20
3ARN	60	3AS	17
3HG	48	3ZO	15

New York City—Most of the "DX" traffic is relayed to upper New York state and to the 1's. 2LM reports that no traffic has been handled due to the installation of his new C.W. set. 2BEA is doing good work with his two 50's. 2BYO also located in the upper west side N. Y. C. zone is relaying quite a few messages. 2ALG reports that no traffic was handled due to trouble in locating a new site for his antenna. 2ALN is a dependable spark coil relay station.

Hudson Valley District—Stations in this section are doing better long distance work. There is a tendency at present for the low power stations to handle traffic direct, there being no outstanding station this month. The route up the Hudson River is still open and working—that is as far up as 2BM, who is on regularly in the early evenings. Considerable difficulty seems to exist in getting traffic through to Albany when it is most desired.

Runyon, ex 2ZS, is using two fifty watt tubes and a superheterodyne. 2KV has been doing the most remarkable work in this section, having WORKED as far west as Denver, and also reported by a ship some distance southwest of Lands End, England. The extreme DX was accomplished with two five watters, using self-rectification. In addition, scarcely a month goes by but what 2KV hears nine or ten districts. 2DK reports his removal to 16 Linda Ave., White Plains, N. Y., where 2DK will resume operation. 2DN, 2AJE, 2BYS and 2AAC are keeping Yonkers on the radio map.

Northern New Jersey—Traffic figures took a slight decrease this month, but the reasons are apparent: many of the traffic men engaged in radio work, i. e., building and installing sets for reception of the broadcasting, practically no traffic moving during early evening period, and the 2nd District Convention did no little to bring

our total down. Considerable disfavor is shown by the broadcast listener to the spark or high power relay operating during early evening, because of QRM effect on his usually-none-too-selective receiver.

2ALY, of Newark reports conditions dead around Newark and slim report from few stations working. 2DX, of Summit, reports 2AAF handling most all traffic through that section in businesslike manner.

Southern New Jersey—General traffic conditions in this district have improved somewhat during the last month and the district as a whole is fairly well covered. There are numerous stations operating and doing excellent traffic work which cannot be included in this report for the simple reason that they fail to communicate with the D.S. or report to their local managers as to the amount of traffic handled, etc.

William Jordan, (3FB) Atlantic City, N. J., has been appointed City Manager of Atlantic City and vicinity. V. J. Braidwood (3BA) Anglesea, N. J., has been appointed Official Station for Wildwood, Cape May and vicinity. F. W. Applegate, (3FP) Trenton, N. J., has been appointed City Mgr. of that city.

Pennsylvania—3FM, Rau of Phila., has established schedules with 3BA of Anglesea, N. J., and that traffic is moving regular between 3FM and 3FS, 3ANJ, 3AAD and 3ZO on every A.M. 1:00 to 4:00.

Mr. Walleze, District Supt. Central Pa. reports that with the exception of 3QR'S C.W. and 8XE's spark few Central Pa. stations are working.

Another C.W. station reaching out well is that of H. L. Strang, 3HL. 3IL uses two five-watt tubes in a self rectified circuit. 3JJ has worked as far as 9IO with his 5 watt "B" battery outfit, and several other stations within that radius. 3LR since having been reported on the Pacific Coast has hoisted his antenna an additional 15 feet, probably with the intention of making Hawaii his next destination. 3ALN and 3ZY recently worked a station signing call letters 6BO, listed in Richmond, Cal., who claims to use 500 watts C.W. and 6-stage receiver. No confirmation has been received from 6BO to date and there is considerable speculation and skepticism as to the real identity of the station worked.

Deichmann reports that due to the seeming lack of interest displayed by the relay men in his territory there is very little to report, with the exception that 3AN has come back in the game after nearly a years' absence. Yearly is back with spark as usual. 3BUR is operated by Mr. Offutt and is using 20 watts C.W. His signals are regularly received in Baltimore. 3BUR will work on schedule with 3HG.

3ZN and 3EM have regular schedules with 3ZY, and 3AJD also keeps schedule with 3KM Washington, and the traffic mov-

ing over the routes has been heavy.

3ZO maintains schedules with 3ZN, 3ZY, 3EM, XN-5, 8ZZ and 1BKQ. 3ZO is QSO 1CJZ, 2CEC, 2BEA, 4BF and 8CKO.

Northeastern Pennsylvania—Log kept at 8ARI shows that reception in this section is pretty fair, although QRN is at the time of writing increasing. Two new spark stations are 8CHV and 8BKA. Those working C.W. are 8ZQ, 8RH and 8ARI. 8ZQ gets through very nicely but is tied down by business.

ALASKAN DIVISION

Roy Anderson, Mgr.

Another month has passed and the wholly obscure silence of our division personnel (as we are wont to call our nine members) inaugurated in 1867, has remained unbroken and we are again at loss to find something to say.

The nation-wide interest which has recently been taken in radio (esp. radio telephone concerts) has reached Alaska, as most hobbies eventually do, and one of the local restaurant proprietors has expressed a desire to install a radio receiving set, with loud speaker, in the lobby of his grill in order to help his customers eat; you remember when Adam said "I love music with my meals; sing to me darling." It is hoped that this plan will be carried out, as it will certainly do much to show people what radio really is.

7IT's much talked of regenerative has arrived in part; the other half is expected on the next air-line express.

WEST GULF DIVISION

F. M. Corlett, Mgr.

Stn.	C.W.		Stn.	Spark	
	No.	Mgs.		No.	Mgs.
5ZA	220		5PE	231	
5ZX	12		5QI	212	
Misc.	50		5XI	191	
			5TC	103	
Total	282		5IF	72	
			5PX	16	
			Misc.	215	
			Total	1040	

What's the trouble, fellows? It is too early for spring fever. It must be the C.W. and fone craze!!! Want more reports from the individual station owner. It is the individual reports that make up the report for the division and if the individual does not do his part the division report does not come up to what it should. Come on fellows, let your City Manager, District Superintendent, his assistants, or your Assistant Division Manager in charge of your Section hear from you so that we can make a representative report on our activities.

Oklahoma—Every "ham" in that state seems to have turned toward C.W.; 5HK,

5LO, 5BY, 5XT, 5FO, 5BM, and others are junking spark and installing C.W. Chas. E. Whartenby, 801, W. Oak, Enid, has been appointed District Superintendent of the North West District of Oklahoma. The eastern portion of the state is going to be the center of C.W., activities during the next few weeks, as all stations in McAlester, Muskogee and Miami are installing either five or fifty "watters."

To 5ZZ, 5JR, 5ZQ, and 5BM of the northern and eastern part of the state we are indebted for the efficient way in which they have handled traffic during the season; however, in other sections 5XT, 5HK, 5EF, 5BY, 5LB and 5FO have also kept traffic moving at a great rate. Let's keep it up fellows!

Northern Texas—5ZAM and Mr. Carr, made several trips over their territory inspecting the different stations and they advise that there are several new stations under construction. 5IC has his C.W. set going. 5TU, 5ZAM and 5IU have handled no traffic in the past month on account of erecting new towers, ground systems, and some new apparatus being installed. 5IS and 5AL are still on the job. A.D.S. West has planned a short jump route from Dallas to Little Rock. 5IR and 5QS have had some hard luck, their 20 wire fans not standing the sleet.

South Texas—Ed. Nettleton, District Supt. of West Texas, was the only one to turn in a goodly lot of news and the report of traffic. Judging from the slender traffic report from the west, we will speak of the situation in a humorous vein and say that "all live wires in this district have turned out to be dry cells." 5ZAN has been ill, resulting in an enforced quiet from his locality. Sorry, OM, hope you are better soon. Assistant District Supt. Wall, 5ZAE of San Antonio, has a lot to say about the ever changing outlook in that city. Just when all the good spark stations there were getting tuned up for biz, someone turned loose the C.W. bug which ruined the prospects for consistent traffic work for a while at least. The only station in the west that has made any noticeable progress this month is 5XI at Kelly Field, operated by Sgt. Lawrence Trost.

Prominent among the C.W. stations in Houston are 5ZX with voice and 900 cycle chopper, 5NK, 5NN, 5PB, 5MY, 5CA with voice on rectified A.C., 5AE, 5PO fone with "the perfect modulation", 5YG, 5SI and 5ZAA. 5ZW is getting good short distance work on DX. 5ZAJ is reaching out with C.W. 5FA, has landed a special and will now answer to deBen's loud call "5ZP." 5ZE holds the medal for the most consistent spark station (when operated) but that is only on Saturday nites. Galveston is well represented in the air by 5TT, 5VY, 5BV and 5CQ.

New Mexico—Traffic still pours through the few stations in New Mexico. 5XD, the station at State College, N. M., is making itself heard. Its sigs have improved 200% in last month. 5XO is now handling traffic over long distances. 5ZJ, also at State College, N. M., helps 5XD in its work. 5FO is reaching out but very seldom heard in this direction. 5ZA is still pushing traffic through on C.W. and fone.

ROCKY MOUNTAIN DIVISION

M. S. Andeline, Mgr.

C.W.			SPARK		
Stn.	No.	Msgs.	Stn.	No.	Msgs.
9DVA	306		6ZAM	132	
9AMB	159		6AFD	73	
9ZAF	82		7ZO	65	
9BJI	31		6SJ	56	
9DTT	30		7ZV	50	
9BEX	18		6ATH	39	
9DW	17		6AWH	37	
9DTH	16		6ZAJ	23	
			7OS	15	
	659			490	

The Rocky Mountain has been very active the past month getting traffic across. Many of the stations have been out of commission at least part of the time, placing an extra heavy burden on the others, but they have shown themselves capable and have handled traffic under the handicap, worthy of note.

Ogden has a new station in operating, 6ZAM, which was formerly 6AEZ before reconstruction, and has opened up a very reliable route east and west.

Stations 6ATH and 6AWH, of Ephraim and Mt. Pleasant, Utah, are appointed Star Stations in the traffic routes as explained in the January report.

CENTRAL DIVISION

R. H. G. Mathews, Mgr.

C.W.			SPARK		
Stn.	No.	Msgs.	Stn.	No.	Msgs.
9ZL	195		9UH	647	
	*179		8BBU	467	
8JL	162		9FS	400	
8AKP	120		9ZJ	354	
8AIM	95		8ZP	350	
WUBC	78		8FT	345	
8BOX	72		9OX	264	
8JU	51		9ME	244	
8VJ	51		8UC	257	
8AXK	50		8EB	153	
8BET	50		9ASJ	152	
8BUR	50		8AJX	130	
8BXH	32		8BEP	128	
8AKC	32		8AOI	115	
9AJH	30		9APS	88	
8FT	28		9AYH	67	
8CLD	28		9YB	66	
8BDO	24		9AZE	77	
9DAX	18		9DYU	65	

9IO	12	8AIB	62
9BLO	10	8CGZ	59
8RR	7	8HG	55
8EB	4	8HR	54
8ATU	3	9AGR	53
8APP	3	8AWU	52
8ML	3	9RC	51
Total	1387	9AIR	50
		8ATU	48
		9YC	48
		9AWU	45
		8BXC	44
		9VZ	42
			*41
		8AIZ	40
		9DGX	38
		8AFH	36
		8BQF	24
		9UW	28
		9ACE	25
		9GU	23
		8BIB	22
		8CLD	21
		8YAE	20
		8VL	20
		8AJE	20
		8TK	18
		9AKD	18
		8ARS	18
		8ZY	15
		8JU	13
		8SG	11
		8BOX	7
		8AHY	3
			*147
		Total	5488
		Not Stated	
*9II	211		
*8BFH	50		
*8BBO	45		
*8BXX	18		
*8BQC	6		
Total	319		

During February and March relay activity in the Central Division has dropped off somewhat, largely due to poor radio weather and heavy static which has been prevalent throughout the Division.

Michigan—We have a good route from Detroit (8ZZ) to Lansing (8ZF) to Grand Rapids (8BNW) and then to west. Messages are handled regularly over this route. 8ZZ handled several messages direct with 5ZA, Roswell, N. M., on 50 watts. We have daily schedule with 3ZO and handled traffic regularly. 8AND of Flint reports things booming in Flint, but not much traffic coming through.

Very little was reported this month on the general progress of radio work. The message reports, however, show that traffic is moving along at a fairly lively rate throughout this District. There are a number of stations which never report their work although it is known that they handle

considerable traffic, and a few others report only periodically. Both spark and C.W. stations are doing excellent work.

Ohio—8AXK, C.W., of Cincinnati is reported as having succeeded in exchanging signals with 6XAD and 6KN. Dayton is beginning to recuperate from the effects of being without a City Manager for a time. Mr. Edward P. Getter, 8AIM, has been appointed.

8ZN reports that 8UO, 8JM and 8BQF of Ashland have been active in handling traffic. 8AJE and 8AJX, at Delaware, with sparks from $\frac{1}{4}$ to $\frac{1}{2}$ K.W. power, have been handling a lot of traffic this season and have been reporting every month on time. 8BET reports that his C.W. is reaching out and he works regularly with 3BA, 3AAD and 9EL. 8VJ, C.W., a sure works. DX fine. The D.S. turned in a Boiled Owl trick at 8VJ and it is no wonder 8VJ does such fine work. His 50 watt tube radiates $5\frac{1}{4}$ amps.

By the way, gang, and 9CP in particular, NA (regular operator) at 8BEP is only 13 years old, and only operating since last summer, and can take 20 words easily now.

Dr. D. A. Crossley, Jr., 8BCO, has just been appointed Assistant City Manager of Cleveland, and with Mr. Marsal, the City Manager, is putting things over in Cleveland in the real A.R.R.L. way. Message reports on regular club blanks are turned in by each Cleveland station. By this method the work of the operating department is greatly facilitated as it renders individual station reports readily accessible.

This month has the largest total of messages for any month and goes to show that everything is in good shape and all stations in working order.

Indiana—Mr. L. B. Wilcox, 9DF, of Angola, Ind., has been appointed A.D.S. Mr. Wilcox will be of great assistance to the D.S. in helping him keep the routes open and in working order at all times. 9AKD reports increased activity in South Bend. Mr. Libbe reports that all stations are tuned to 200 meters and are co-operating with him in order to reduce QRM. 9AGR states that he is on mostly in the mornings. This is the first evidence of activity in that direction. 9HR is on every Friday, Saturday and Sunday nights. Regular schedules can be arranged with any station on these nights.

WINNIPEG DIVISION

Boyd Phelps, Mgr.

Nothing unusual to report from 4BG. Plans for a Canadian cross-country route are under way. 4BR and 4BV are work-in OK, but rotten weather has made it almost impossible to do much. The Moose Jaw Amateur Radio Association is putting in a 100 watt CW set. The schedule be-

tween 4CB and 7LY has been a failure as 7LY cannot be heard. 7MP comes through once in a while.

MIDWEST DIVISION

L. A. Benson, Mgr.

C.W.			SPARK		
Stn.	No.	Mgs.	Stn.	No.	Mgs.
9PS	96		9ARZ	642	
9FM	90		9JL	125	
9SJ	30		9ATN	98	
9DEH	28		9ZH	75	
9BNO	23		9FK	73	
9YM	22		9DZI	61	
9IY	14		9DCF	30	
St. Joe	34		9AOJ	29	
St. Louis	122		9BRS	26	
			9DJB	25	
	459		9YM	21	
			9OA	19	
			9BMI	12	
			St. Joe	34	
			St. Louis	123	

1393

This Division has been improving by leaps and bounds and since the new officers have been appointed messages have been moving fast, and interest has been at high tide.

Iowa—Among the prominent stations are 9DEH, 9OA, 9IY, 9BRS and 9BMI. 9LY has a five watt C.W. set installed and 9DEH a 15 watt set. 9ARZ reports a marked increase in message traffic in the northern part of the state. 9AOU has changed from spark to C.W. 9BGI, 9DXC, and 9DXU are doing good work. 9DOF has a ten watt C.W. and handles a large amount of traffic. 9DBL is on with C.W. 9ARZ is on every A.M. and handles traffic with 9DNC of Lincoln, Neb. 9QE and 9DSW prove very good outlets for messages going north. 9BFG has a ten watter and is stepping out. Three good stations are on the job in Mason City, 9AMI, 9DJM, 9DKY. Among the Fort Dodge outfit are 9BCF, 9UL, 9AXA, 9DAH, and 9BLZ. 9AXU is doing excellent work with his rock crusher. 9DAU's spark is reaching out. 9AFW (spark) is on every night and is an excellent relay station. 9BGH, 9DZQ and 9BIK are getting on the air with C.W. 9AMU has his ten-watt whistle working.

The main routes for the state of Iowa are finished and in use with all but a few stations on them operating. At present the routes are planned so that there will be three main routes running east and west through the state and two main routes running north and south. The distance separating the stations is short enough to allow skipping in case a certain station can't be raised.

9ACN and 9DRA are burning up the air at all hours of the morning and are very reliable stations.

Kansas—We report the appointment of 9AEG as City Manager of Eldorado. There has been a great increase in the number of reported messages in the state since the date of the last report, 578 messages reported by 11 stations and again 9DSD takes individual honors. Wichita stations handled 139 messages. 9PS clears without difficulty in all directions and was heard taking a message from 3ALN and giving it immediately to 6JD on the west coast. He was a spark man two months ago but has done as so many old sparks are doing—using his old OT to improve the ground, and it is reported that a great number of large thick pieces of plate glass are pinch-hitting as paper weights in his station. Eldorado traffic has fallen off due to the inability of 9AEG to devote much time to traffic, and the illness of 9AQE. Hutchinson traffic has increased in all directions but particularly south and west. 9DSD clears through 5IF and 6ZZ. 9DUG, 9AOD and 9QD are installing C.W. 9AOG has a 50 watter in transit. 9RV is now using his MG set and it makes a joyful noise in the phones. The time is coming when this station with 9PS will have a chance to demonstrate what a few watts of CW can do in the constant QRN for which Kansas is noted.

Missouri—This state is showing the results of organization already and we have barely had time to get started. If one can judge the future by the present, then "watch our smoke." Organization of Eastern Missouri is being accomplished in conjunction with Western Missouri. Messages are being handled nightly by 9ACB, 9FU, 9WT, 9BED, 9DZY, 9ARG, 9ARQ and 9ZB.

The following gentlemen have been appointed by Dr. Klenck to act as his assistants:

Fred W. Schramm—9DFQ—1st Asst. Supt. & City Mgr.

Kent Ravenscroft—9WT—2d Assistant Supt.

Lorraine F. Jones—9ACB—3rd. Asst. Supt.

9ANO is back on the job. 9AFG has a good C.W. station and is doing good relay work. A new order has been originated in St. Joseph, namely; the accepting of no messages for QSR unless they are sure of getting them off without much delay. The fellows say it surely is good plan and helps to keep their hook clear of messages that have poor address. Mr. Abercrombie has appointed the following men to act as assistants to him:

Duncan Cox, 9ANO, City Mgr. for St. Joseph.

Sid Blume, 9FM, City Mgr. for Kansas City.

A new route is in operation to St. Louis, via 9AMA, 9DQQ at Sikeston and 9AEK at

Cape Girardeau. The same old routes are in operation besides this new route. 9AJN at Jefferson City clears thru 9MC in Roodhouse, Ill., very easily in daylight.

PACIFIC DIVISION

J. V. Wise, Mgr.

C.W.		SPARK	
Stn.	No. Msgs.	Stn.	No. Msgs.
6ZB	37	6ZZ	194
6AK	4	6GT	176
6ZX	2	6ZX	155
		6HP	107
	43	6OL	32
		6FH	30
		6ZB	1
			695

Southern Section—Lack of promptness in submitting reports is mainly responsible for the apparent poor showing of the Southern Section. A fairly large volume of traffic is really handled, but due credit cannot be given in QST unless we know of it by some other means than hearsay. Contrary to expectations, no regular traffic routes have been layed out, owing to the extreme difficulty of finding a sufficient number of stations willing to stand regular watches; however, there are enough stations operating at will to ensure messages going through in reasonable time.

C.W. is making a better and better showing, aided by the fact that so many of the reliable sparks are changing to the new order; long distance jumps east will soon be almost exclusively handled by this means. The fact that C.W. still has some drawbacks is apparent in that it cannot be copied satisfactorily in San Diego through NPL are mush on 375 meters, although a powerful spark carries through.

The new Pacific Plan of traffic regulation, with its machinery for enforcement, is solving the QRM problem for all time. This plan having been endorsed by all Pacific Coast Radio Clubs, it is not surprising that amateurs are making the traffic officers' job an easy one by a universal willingness to co-operate for the common good.

The only known exception to this rule is in San Diego, where a small group of operators have combined in an effort to evade the new rules and use the air according to their own sweet will, without regard to anyone else's convenience. The most industrious members of this group have been barred from all further participation in A.R.R.L. work, and all stations are requested to note their calls, so that no traffic may be handled with them. The list follows: 6HH, 6ADA, 6AEH, 6BKH. The license of 6HH having been revoked by the Department of Commerce, the boycott will not apply against the per-

sons to whom it is reissued. 6BKH, under his old call, 6XZ, has already been under A.R.R.L. boycott for about a year.

District "A" (Arizona)—Our worst QRMers, the 6's, have been QRZ all season. Traffic from the west comes through very well from nearly all the C.W.'s, even the 5 watt stations; about forty messages were received from 6XAQ, who is doing exceptionally good work. Going east, about 100 messages each way were handled with 5IF (C.W.); other eastern stations regularly worked are 9DSD, 5ZAK, 5XU, 5IR, 5ZAC, 9AEG, etc. The majority of the work in Arizona is handled by 6ZZ; others doing good work are: 6AAH, 6ASV, 6GS, 6AFP, 6ZC. 6TV cleared traffic west very well for a time on spark, but is no longer heard and is supposed to have closed up.

District "B" (Arizona)—Riverside County reports only one station handling traffic, 6GT. As heard on the air, there have been many stations in this district showing increased activity. Among these are the following, which are doing good DX work: 6GT, 6FK, 6OE, 6EV, 6BAZ, 6TW, 6ACJ, 6AHF, 6AGK, 6AKC, 6AQY, 6AUC, 6BJV and 6AJH. Inactive hams please note that 6AJH, still on his back in bed following his fall with his mast, has his headset on the major part of the day and is doing all in his power to help put District "B" on the map. 6ZB's 20 watt C.W. has been copied in New Jersey, according to a card recently received. 6BAZ, our sole YL (OW) has reached out as far as Sacramento on her ½ K.W. spark. 6FK and 6AGK will soon be added to the C.W. ranks. Now you fellows in District "B," let's get together and get all of our reports in when they are due, so as to have a real showing in the future.

District "C"—The natural trend is toward C.W.; nearly all the good old sparks are gone. C.W. stations now handling regular traffic are: 6JD, 6ZG, 6EN, 6KA, 6CU, 6KY, 6RR, 6EA, 6EB, 6ZN, 6ALU, 6XAQ, 6JD and 6EN are both using two 50 watt tubes, 6KA and 6RR are using one 50 watt, and the rest are using one or more 5 watts. On February 22nd, 6KA exchanged greetings with 8JL, Cleveland, Ohio, and 6EN handled traffic with him without QTA on either end. 8JL reported that both could be read with the phones on the table.

6EN has also handled traffic with 8XV, and is going to establish a definite transcon schedule with him. Nearly all the sparks that are handling traffic are in or around Pasadena; among them are: 6MH, 6OL, 6OM, 6ADL, 6ACY, 6AMN, 6ALD, 6ALU, 6LC, 6GP. (6LC is so loud in San Diego that he often cannot be distinguished from a local spark.) An Assistant District Superintendent will be appointed for Pasa-

dena. Los Angeles is the star region for traffic.

District "D"—The only two stations heard in this district are 6ZU and 6AIF C.W. and spark.

District "E" & "F"—We find the old reliable on the job as usual. 6TU and 6OX in particular are doing excellent work followed closely by the Santa Cruz fellows. 6AS reports the gang doing fine work, but to get any material out of them to be used in a report, so far, has been impossible.

A number of stations in the vicinity of the Bay have been copied by 6ZAC in T.H. so this proves the stations are O.K. and all we need is a word from their operators. Adjoining District "F" is District "G." This District will also have a District Superintendent next month. 6EX and 6AH are kings of sparks in Oakland yet; and have been on the job very regularly. 6HP in Richmond is doing fine work and on little power too.

District "H," 6GF, Superintendent—This district has suffered the loss of most of its A1 stations this last month. The rebuilding bug hit them all at once, altho we have no word of an increase in wages. 6FH, and 6ZX, were left to handle most of the work and had little trouble in doing it. Both these stations are now equipped with C.W. and spark, 6ZX using C.W. on 375 and 200, spark on 200 only.

District "I"—The only station heard in this entire district last month was 6AIX, who goes north fine, but not south, and for this reason he can only get a limited amount of traffic.

District "J"—6BIP has made his appearance on the air with a good spark set. 6ZO is back in Reno and is installing a C.W. and fone set. 6MO has been reported as QRK in Washington, D. C. However, he is not handling traffic regularly. A spark in use at 6UO. 6AJR of Reno has been an old reliable all this last month. His spark is making good now.

ROANOKE DIVISION

W. T. Gravely, Mgr.

Heavy sleets and storms have played wild with a good many stations in the division this month but still the old faithfuls have been on the job and traffic has moved through with fair rapidity. The number of C.W. stations is on the increase.

SSP has joined the ranks of the illustrious for his sogs have been heard by 6AME and 7ZS. He has now been heard in every district. Fine work, OM, hope you will be able to make an every-day thing out of it soon. West Virginia leads in the number of msgs. handled and in general efficiency for th month. There are now several stations that form almost constant watch, probably the star station being

8AXY who is using spark to fine advantage. 8AFD, 8WD and 8AEU all spark doing fine work. 8AXY is reported to stay up all the time. Wonder how he ever finds time to sleep. 6's and 7's are copied by him 'most any time.

Virginia seems to be quiet for the time being, due to several good stations being out on account of sleet and sickness of operators. Several daylight stations have been opened up, among them being 3BLF and 3BII. There is need of a good station in Petersburg—who wants the job? General activities for the month have been a little under par.

North Carolina is gradually getting in better shape. There have been added several new C.W. stations during the month, one at Asheville and another at Shelby. Stations in general have been doing very good work but bad weather conditions have somewhat hampered activities. Asheville is within daylight range of Winston-Salem who has a daily schedule with Danville 3BZ. Charlotte, Shelby, Greensboro and Salisbury are all on within daylight range of the Manager's station, making it easy for the Division Manager to communicate with the whole Carolina end of his route by short jump routes.

Traffic in general for the month has not been up to the previous months' record. Several stations that had previously handled considerable traffic have been out with aerial trouble, on a number of occasions. Co-operation is the thing that will get results for the division and if everyone is on the job and puts some life into things then the old division will go to the top and hold the place that the Manager hopes for it to assume.

DELTA DIVISION

H. E. deBen, Acting Mgr.

C.W.		SPARK	
Stn.	No. Msgs.	Stn.	No. Msgs.
5LA	42	5DA	75
5JB	21	5AA	69
5WF	7	5JD	69
		5KC	36
	70	5YE	15

264

Relaying in the Division slackened up to some extent during the past month due mainly to the steadily increasing QRN. However, we are determined not to give Old Man QRN another summer victory and accordingly are working out short jump relay routes throughout the Division. All stations desiring appointments on these routes are invited to communicate with their District Superintendent. It is hoped that by organizing short jump relay routes, with stations located from 50 to 100 miles apart, and with the aid of

C.W. that we will be able to pierce the worst QRN. In this day of radio frequency amplification, loop aeralis, and highly efficient transmitters, the feat should not be a difficult one to accomplish.

Arkansas—5JB, Roy Disheroon, has been appointed City Manager of Hot Springs and is doing fine work with his C.W. set. 5UE has been appointed official relay station for Conway. 5JD continues to do good work. 5ZL has just returned from St. Louis chuck full of pep and a head full of knowledge—we know things are going to wake up now. Bro Jawn learned a lot about controlling QRM out St. Louis way and will no doubt show us how it's done.

Louisiana—5KC has been handling a goodly bit of traffic of late and his sigs continue to increase in strength. Two newly licensed stations now on the air: 5ABA 10 watt C.W., and 5AAT $\frac{1}{2}$ K.W. spark at Baton Rouge, also plenty of squeak boxes. 5ZAB out of operation due to remodeling and installation of C.W. transmitter. Manard, City Mgr. of Nola, reports that the only stations working DX are: 5HO on 50 watts C.W., 5LA on 15 watts C.W., and 5AA on $\frac{1}{2}$ K.W. spark. 5HO, a newcomer in the League, has a 50 watt bottle pouring 3 amps in the antenna and has been reaching out to real respectable distances. 5LA is still using 15 watts but gets out even better than formerly.

Mississippi—5YE is still the only DX station in the state of Mississippi and is indeed well capable of taking care of all Mississippi traffic. 5YE has handled much traffic during the past month.

Tennessee—All DX stations continue to do good work in spite of bad weather conditions. 5FV is heard nightly and is handling his portion of the traffic. 5KU has been appointed City Manager of Memphis. Mr. King has a 20 watt C.W. set which is putting the traffic over in fine style. 5DA continues to defy the elements out his way and we take the liberty to predict that this will be one station that will cause OM QRN to utter a groan.

ONTARIO DIVISION

A. H. K. Russell, Mgr.

C.W.		SPARK	
Stn.	No. Msgs.	Stn.	No. Msgs.
9AL	30	3EI	32
3EI	5	3JL	18
	—	3GN	17
	35	3BA	14
		3QJ	4
			85

March has been excellent for relay work, but as usual the D.M. has the greatest difficulty in coaxing the different districts to make reports, and he hereby appeals to the various members of the A.R.R.L.

throughout Ontario to unite in an effort to make the monthly report a really representative report of relay work throughout the division. We have this month only reports from the Districts Nos. 2 and 3.

Gowan reports aeralis springing up like mushrooms all over his district. 3TP has opened up a phone transmitter and if he can be induced to use CW he will give 3BA a run for his money. 3QJ is being changed to 3TY. 3SB is still putting in that CW set. 3GN states that sigs from Toronto are rarely heard there, and then QSS very badly, tho strong and steady in Windsor. He reports 3MN clears London traffic regularly, and 3DL helps out lots. Tillsonburg 3RV and 3TA are both good.

Toronto district No. 3 has done well. 3EI reports working as far as Miami, Florida, with his $\frac{1}{2}$ K.W. while 3JI, a new 5 watt tube set, in nine days from opening up handled 5 messages and worked to Iowa.

No reports have been received from other districts but Rogers 3BP was heard working 6BO one night this month on his C.W. set.

The new laws are not yet in force in Canada, but an inkling that they are easing is that Ottawa has issued an order that on opening of navigation all C.W. stations are empowered to carry on on the winter wave, i.e., 200 meters. Spark stations on the contrary return to the summer footing, i.e., 50 and 100 metres. That sounds like ding dong bell for the poor old pebble squashers.

NORTHWESTERN DIVISION

H. F. Mason, Mgr.

What's the matter, fellows? Don't let the first splash of summer static, or the radio telephones get your goat. Stay on the air, and be one of our RELIABLE stations. With the coming of summer it's going to be harder to clear traffic, and we need your help. We are calling on EVERY station to send in a report of activities to his nearest division officer on the 15th of the month. Don't let yours be missing.

Eastern Section—Traffic has been moving in good shape, although many of the operators were off on account of the flu a good part of the time. 7ZU and 7XB report few messages handled. 7LY also indulged in the flu, but was on strong during the Pres.-Gov. relay. The C.W. fever has at last taken the state of Montana and there will be a couple of good CW sets in Helena soon, and a 20 watt set at 7XB which will be followed by a 100 watter. They plan to work both Seattle and Chicago direct. F.B., 7MP of Bozeman takes the honors for most messages handled this month, and has worked 54 stations, even in spite of a crippled condenser.

Central Section—Activities in this section have taken a dip since 7NL, 7FI, and 7ZS are off the job. This leaves 7ZM

and 7YA on 375 the only stations handling any amount of traffic, and even 7YA reports hard times. As this section is depended upon for handling practically all of the eastern traffic from the western part of Washington and Oregon, it is essential that at least one good 200 meter station be on the job.

Washington Section—Puget Sound stations continue to work consistently, especially to the south. Stations handling the bulk of the traffic are 7BC, 7BK, 7QB and 7HI. 7GE at Pasco, Wash., is also doing good DX, but no reports. 7QB has a schedule with 4CB (Canadian) to handle eastbound traffic on C.W. Down at Grays Harbor, 7SC is installing C.W., I.C.W., spark and fone, and reports activities on the increase since he arrived. 7KJ and 7NN are the principal stations there at present.

Oregon Section—7KE, newly appointed D.S. at Myrtle Point, Oregon, reports that he is working easily into the 6th District, covering 600 miles on a quarter kilowatt. 7OX is putting up a half K.W. set for DX work.

In Portland: 7DP has been clearing traffic on C.W. Sparks who have been doing DX are 7JW, 7ZT, 7GJ, 7ED and 7ZJ. The number of messages handled, tho, is extremely low, and is a very poor showing against what these stations have done in the past. 7ZK of Vancouver, Wash., is back on the job, surprising the fellows with a 500 cycle spark. No reports from Eugene or Salem although 7MU at Salem is reaching out on spark since 7TJ has gone to sea. 7HD, D.S. at Seaside, has his transmitter going again and is QSA through the division.

EAST GULF DIVISION

B. W. Benning, Mgr.

C.W.		SPARK	
Stn.	No. Msgs.	Stn.	No. Msgs.
4GL	475	5XA	192
4BY	329	4EZ	56
4FT	200	4AU	55
4II	142	4GN	46
4BF	121	4BI	45
4BQ	65	4HS	35
4YA	48	4GM	25
4CO	40	4FD	24
5XA	36	4DZ	12
4AZ	30	5GI	13
4ZE	30	4DH	9
4EL	25	4GU	5
4IW	25	5ON	1
4GE	18		
4AS	15		518
4ZF	10		
4BK	9		
5ZI	1		

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Florida—4ZE is trying some of the

new tuners for the coming season. He has a regular route now with 4DZ, which opens South Florida. 4FS has completed his C.W. set and is in line for traffic. 4BC continues to do DX and is improving his set for summer work. 4DZ is doing regular work with 1BQE, 3EZ and 4GN. This opens South Fla. in good shape. 4AW, our last winter's standby, has started a C.W. set. W. E. Wood, 4BS, has gallantly offered a report for Miami and we thank him. Miami has 10 licensed amateurs, with sets ranging from spark coils to 1 K.W. sets; 4ES has a good station and is going to install C.W. At St. Petersburg the local club is building a set to specifications and are having nightly code practice. 4IW, C.W., is on the air and does regular DX. 4BF broke loose about three weeks ago. This fine station has already been reported QSA on the Pacific Coast several times.

4II has been reported QSA in Burlington, Ia., and Newmarket, Ontario. Supt. Harrod is pleased to say that every city manager has been striving this month to show that the land of Palms and Placid Lakes contain real radio men. 4ZC is doing fine work, having worked into 34 states and Canada.

Alabama—City Mgr. Ansley of Birmingham reports that their one and only spark DX station, 5GI, was closed down for the most of the month, following a complaint made to the R. I. that he, 5GI, was interfering with radio-phone reception—the receiving station making the complaint was located about two blocks away and using two steps of R. F. amplification!!! Hi. 5GI has been given permission to open up again. This trouble of interfering with radio-phone reception will probably cease if the plans of the B'ham Wireless Assn. are adhered to. 5ZI, C.W., has broken through to 5XA and 8ARS and has handled one message. He reports that there are six licensed amateurs in Anniston. Mr. J. K. Moore has been appointed City Mgr. of Gadsden.

In Montgomery, City Mgr. Brooks reports that all DX work has been given up due to the fact that all the possibilities are spending their time listening to the phone concerts. (We wonder if they listen all night. DX work doesn't start before 11:00 P.M.) 5NI has given up blowing condensers on his rock crusher and is building a low powered phone set. 5XR has installed C.W. City Mgr. Barnett of Mobile advises that the Radio Inspector recently visited Mobile and assisted by the chief operator of NGT tuned all the amateur stations there. 5KB is on 200 and 5JZ on 195 meters. Two new 5 watt C.W. stations are 5ACO and 5ACB.

5XA in Auburn has been the old standby and is still trying to do the work that 20

or 30 stations ought to be doing in this state. The 10 watt C.W. set is putting out .8 of an amp. and 750 miles is easy work for it.

South Carolina—4LA at Spartanburg has been absent from that city for some time and communication between 4LA and 4EG has been suspended. 4EG has established communication with 4AS at Macon, Ga. 4LA, 4IB, 4HR, 4HG and 4FI are in operation. Supt. Etheredge thinks that much progress will be made by his state during the next month and that we will have some reliable relay routes through the state by May.

North Georgia—Supt. Hight reports ports his district quite active during the past month. Extreme interest in radio has been exhibited by citizens in general. 4BQ made a talk before the Kiwanis Club of Rome, his subject being "Amateur Wireless and The American Radio Relay League." By request he repeated this talk before the Rotary Club and the Berry's Industrial School. 4BQ's CW signals are being heard all over the United States and Canada; he had 42 reports from the Pacific Coast in 20 days of operation, such reports including Vancouver, B. C., Seattle, San Francisco, Los Angeles, and Sacramento.

Middle Georgia—Midville 4GN has no trouble in working Fla. stations, having handled traffic with 4EZ. 4FD junked his CW for spark again. 4DH is putting in a 50 watt CW set. 4AS in Macon has been reaching all over the country with his new 10-watt CW set and is handling a good bit of traffic. 4GU, also on 10 watts of CW, has been stepping about over DX. 4BW reports that he has at last found a condenser that will hold his gravel grinder and is getting over the back fence. 4JH has installed a 50 watt CW set in place of his 10 watt and is in line for relay work at the present writing. 4BK swore off radio again. (HI—This is the fifth time Rankin has quit in the past 6 months. He will come back in a few days—he always does.)

South Georgia—That famous combination of 4GL, 4BY, 4EL, and 4GE smashed all our traffic records again this month and seem to be real angry that Atlanta had the nerve to nose them out of first place last month. Supt. Hodge reports that steady communication is held with Florida stations 4ZC, 4BF, 4IF, and 4II. Reliable communication is had with 5XA of Auburn, Ala., and 4FT of Atlanta. Won't some of you new radio men of Talbetten, St. Marys, Waycross, Boston, Valosta, Beuna-Vista and other places get in touch with Supt. Hodge? In Atlanta, 4FT was decreased somewhat this month due to the fact that the "Atlanta Constitution" is using the station temporarily for a broadcasting station.

DAKOTA DIVISION

Boyd Phelps, Mgr.

All district superintendents are busy lining up stations in the smaller towns for summer relay routes over which messages must be handled to insure delivery. The Southern Minnesota District is particularly lively in this respect and it had occasion to show its worth during the isolation of the Twin Cities when storms cut off all communications.

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912.

Of QST, published monthly at Hartford, Conn. for April 1, 1922.

County of Hartford }
State of Connecticut } ss.

Before me a Notary Public in and for the State and county aforesaid personally appeared K. B. Warner, who, having been duly sworn according to law, deposes and says that he is the business manager of QST and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 443, Postal Laws and Regulations, printed on the reverse of this form to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are: Publisher, The American Radio Relay League, Inc., Hartford, Conn.; Editor, Kenneth B. Warner, Hartford, Conn.; Managing Editor, (none); Business Manager, Kenneth B. Warner, Hartford, Conn.

2. That the owners are: (Give names and addresses of the individual owners, or, if a corporation, give its names and the names and addresses of stockholders owning or holding 1 per cent. or more of the total amount of stock). The American Radio Relay League, Inc., an association without capital stock, incorporated under the laws of the State of Connecticut.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent. or more of total amount of bonds, mortgages, or other securities are: (If they are none, so state.) None.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear on the books of the company but also, in cases where the stockholder or security holder appeared upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

5. That the average number of copies each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the six months preceding the date shown above is..... (This information is required from daily publications only).

K. B. Warner

Sworn to and subscribed before me this 24th day of March, 1922.

Wm. Lacey Wells, Notary Public

(My commission expires February 1, 1925.)

Who's Who in AMATEUR WIRELESS



B. W. Benning

"Our Genial Division Manager"—as all the fellows in the East Gulf call him—was born in Atlanta, Ga., March 9, 1897. Having been interested in electricity since 1909 he was the easy victim of the bite of the wireless bug in 1913. The first symptom of this awful disease was inflicting a coherer and other miscellaneous junk upon the household. In 1915 he graduated (with all due honors) from the spark coil class and for two hideous months radiated so much QRM on the DX men of the city that they threatened several different kinds of murder. He was finally taken into the Atlanta Radio Club and educated by pre-war 4CL, 4BY, 4AT, and 4DG. Installing a 2 K.W. open core transformer with electrolytic interrupter in 1916, he blossomed out with the call 4DX. "DX" was a good call but didn't mean anything.

During the war he served in the Navy

(Concluded on page 54)



Albert J. Lorimer

Born Nov. 7, 1897, at Farnham, Quebec, Canada, our Quebec Division Manager launched his radio career soon after. Troubles with land-line telegraphy in 1912 turned his interests to radio. Passing from the coherer to the potato detector stage, and from the spark coil to the quarter kilowatt, this rival of Marconi stepped forward in the world.

In 1915 he moved to New York City and entered the service of the Western Electric Co. When the lid was lifted he was located in Montreal and operated Canadian 2BF with a $\frac{1}{2}$ K.W. quenched outfit and worked 2TF at Schenectady with fair regularity. Later when the resulting QRM hindered VCA the spark set was gotten rid of and a 250 watt I.C.W. installed, resulting in a great increase in range. 2BF is now being relocated at Farnham and will soon be heard from.



CLUBS wishing information on how to become affiliated with the American Radio Relay League can secure same by addressing a letter to the Traffic Manager, A.R.R.L., 1045 Main St., Hartford, Conn., who will be glad to furnish the necessary application blanks. There is no charge for affiliation. Every good radio club, society, or association is eligible for affiliation.

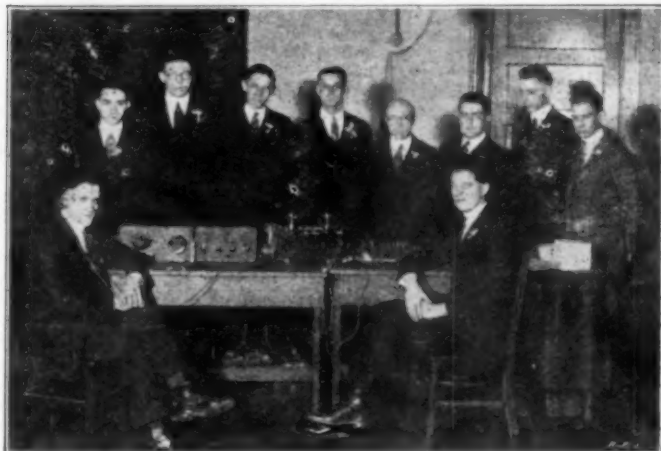
The Detroit radio clubs have adopted a novel scheme for enforcing their regulations. They have several blanks of different colors which are used to report viola-

Andrew White and W. A. Easton. The dance was held February 24th.

Interesting lectures are given every week and one of the most important of all will be a lecture by Paul F. Godley, our hero of the Transatlantic Tests. His subject will be the "regenerative receiver". The club extends an invitation to surrounding organizations of the second district to send their delegates to this meeting which will be held on Tuesday evening May 9th at 8 P.M. sharp.

The officers are R. H. Horning, pres.; G. Bosler, vice pres.; C. A. Reberger, secy.; H. Ryder, treas.; H. Luttgens, traffic manager; P. J. Larsen, technical advisor.

The following papers were received sur-



Officers and members of the High Power Committee of Roselle Park Radio Club, and set used at radio dance. Left to right, Wm. Pinter (sitting); M. C. Lane, P. J. Larsen; C. A. Reberger, sec.; R. H. Horning, president; G. Bosler, vice-pres.; H. T. Ryder, treas.; F. Schifle, J. Smith, and H. Luttgens (sitting).

tions. When a station is violating the regulations several amateurs sign a blank and send it to the station and another copy to the radio inspector. For the first offense a blue blank is sent for warning. No mention is made of other colors except red—and a red blank means action by the radio inspector. The scheme works splendidly and as yet no one has received the "red ticket".

Roselle Park (N. J.) Radio Club

The first affair attempted by the club was a dance with the music furnished by WJZ through the courtesies of Major J.

ing the month and we advise all of you to read your local paper as some very vital points can be cleared up in your locality through the medium of such means for distributing information.

Totem Radio News—official organ of Totem Radio Club.

Delta Division News—by Delta Division A.R.R.L.

The Radio Log—by Radio Club of Brooklyn.

The Michigan Radioist—by Central Michigan Wireless Association.

The Oscillators—by Radio Engineering Society of Pittsburgh.

The Modulator—by Radio Association of Greater New York.

The Oscillator—by Y.M.C.A. Radio Club of Sioux Falls, S.D.

Kickbacks—by Twin City Radio Club.

Scenic Highway Radio Club (Clinton Ia.)

The club held its annual election February 13th and is pleased to announce the following names to serve for 1922: G. A. Gummerson, pres.; W. Pringle, vice pres.; G. Stukas, sec'y-treas.; J. Baker, corres. secy.

Four operators will handle traffic on the new 1 K.W. spark set which is in operation. Single circuit tuners are used extensively by members of the club. (Come on—give us some dope on them.—T.M.)

Ypsilanti (Mich.) Radio Association

The meeting of the past year consisted of code practice and lectures. The membership has nearly doubled in that time though there are but three licensed amateurs. F. N. Furlong has been elected president vice F. F. Sims who left for the Naval Academy.

Southern Ontario Radio Association

New officers for the coming year were elected at the last regular meeting: R. E. Moore, pres.; K. S. Atkinson, vice pres.; R. C. Hunt, treas.; C. R. Waage, secy. The advisory committee consists of D. Aitchison, W. Baker, and R. Bridwell. The welcoming committee—C. Lane, G. Brett, and J. Green. The traffic committee—R. Moore, R. Bertrand, and H. Wilson.

Haddonfield (N. J.) Radio League

New officers for the coming year are: E. Farrington, pres.; J. L. Barnes, vice pres.; E. Braddock, secy.; G. Barnes, treas.; J. G. Haydock, chairman of technical committee.

Regular meetings are held every other Saturday evening at the home of Thomas Sherrod.

Fort Worth (Tex.) Radio Club

The semi-annual election of officers was held March 2nd. The following officers were elected: Prof. O. R. Garrett, pres.; R. L. Harris, vice pres.; M. Smith, secy and treas.; O. Yeary, sgt.-at-arms. Prof. Garrett will start a series of lectures that will cover the field from beginner up.

Mystic Valley (Mass.) Radio Club

At the last meeting new officers were elected for the year of 1922: E. Baker, pres.; L. Gordon, vice pres.; E. D. Austin,

secy.; L. Hitichens, treas. The club will be glad to exchange correspondence with all radio clubs. Address all mail to the secretary at 1 Kern St., Malden, Mass.

Philadelphia Amateur Radio Association

At a meeting on March 6th, a paper on



Photo of Roselle Park Radio Club members and their apparatus, on the night of the affair

"British Aircraft Tube Transmission" was read by W. B. Martin.

Some very amusing questions on radio which were taken from a New York newspaper were read by the president. A discussion on "radio frequency amplification" was led by H. Van Sciver. The discussion was fully covered. (We would like to know the result of the discussion.—T.M.)

Hudson Amateur Radio Club (N. Y. C.)

The Hudson Amateur Radio Club meets Saturday evenings at the Columbia Preparatory School, 301 West 8th Street, New York City.

Mr. Stern of the Western Electric Company spoke on various types of antenna in common use; Mr. Gawler of the Radio Corporation of America spoke on the history of the Amateur Radio in the New England States, and Mr. D. S. Brown of the Radio Club of America gave an interesting talk on the theory of vacuum tubes with their application to modern receiving circuits. Mr. C. G. Kilbourne, our Vice President, also spoke on getting the most out of our C.W. sets. We have also been favored with short talks by different members of the club.

Over sixty percent of the members are licensed amateurs holding either first or second grade licenses.

The club is a member of the Second District Executive Council.

8AGZ Heard in Hawaii!

The latest station to be reported by Mr. Dow, 6ZAC in Hawaii, is 8YT, formerly 8AGZ, the station of Mr. C. J. Carter at East Cleveland, Ohio. 4500 miles on 100 watts, 375 meters. Fine business!

Strays

Regarding the article on loop reception by 3ZY in last QST, the experiments have been continued and it was found that the large two-turn tickler was not as good for regeneration as tuning the plate circuit with a variometer, and the latter plan has been adopted. All of the secondary was then placed on the loop itself. The result now is that with two stages of audio amplification a lot of DX C.W. is being heard readably all over the room.

To check the possible effect of the antenna, the set was taken to a vacant lot—and better results got than ever.

Irving Vermilya, "VN", 1ZE-ex-1HAA, "Amateur Number One", old-time brass pounder, manager of Marconi's old WCC, and more lately Senior Shift Engineer at WBJ, Marion, Mass., left the employ of the Radio Corporation on April 10th to become the manager of the new radio department of a New Bedford firm, Slocum & Kilburn. Going to carry everything from crystals to 99-stage amplifiers, VN says, and even going to run a 250-watt broadcaster. Regular pirate!

We know that all of Familiar's friends join us in wishing him best of luck in his new job.

"To hell with C.W."—1ZE, August 15, 1921.

"I am now in favor of passing a law against all sparks—no excuse for them."—1ZE, March 31, 1922.

Who put the broad in Broadcast?

The Weston Elec. Inst. Co. of Newark, N.J. announce the appointment of the following Sales Representatives:

Shiefer Electric Co., Inc., with offices at Rochester, Buffalo and Syracuse, for upper New York State and Erie, Pa.

L. D. Joralemon, Otis Bldg., Philadelphia, for Pennsylvania, Delaware, Maryland and District of Columbia.

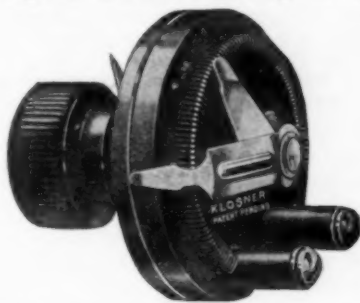
Warren C. Graham Co., Carondelet Bldg., New Orleans, for Louisiana, Mississippi and Lower Alabama.

The Anthracite Radio Shop, P. O. Box 3, Scranton, Pa., of which Roy C. Ehrhardt is treasurer, has succeeded the Shotton

Radio Mfg. Co. in that city, the latter company now being located in Albany.

S. M. Kintner, who is well known for his research and engineering work in the development of radio apparatus, has been appointed manager of the research department of the Westinghouse Electric & Manufacturing Company, succeeding C. E. Skinner, who has been made assistant director of engineering in the Westinghouse company. He will be located in the research laboratory building near East Pittsburgh, Pa.

Here is an illustration of a new vernier rheostat, the Klosner, which is especially designed for gaseous detector tubes requiring critical adjustment. In addition to the regular rheostat winding it has a



second resistance consisting of a single turn of the same wire running around the base of the device and provided with another contact arm. A single knob actuates either slider, the shaft to which the vernier is attached pulling out to engage a clutch on which the main contact arm is mounted.

The young lady across the way says she heard that nice Mr. Hanson of 9XM say he had gotten rid of his corona. She supposes the poor man will have to keep up his correspondence in long-hand hereafter.

The young lady says Mr. Hanson said the stations along the Mexican border just eat up all the C.W. he can feed them. She says she just can't keep up with all those new breakfast-foods anyhow!

9YAE of Le Mars, Ia., informs us that at present they use spark instead of C.W. as reported in the March issue.

Allow us to extend our condolences to A. Ham Wright. He asked a friend what he could do with his pet Tron tube having a broken-off grid lead and was advised that it would make a fine bobber for a fish line. He is now being held by the County Game Commissioner on a charge of fishing with lights!

A new way to test amplifier tubes: tap with a hammer to determine the degree of hardness.

We understand WLB-9XI is broadcasting potatoes on 485 meters. Moral: Run your lead-in to the dining room.

DID IT EVER OCCUR TO YOU THAT: An old 4D coil has a good filter condenser in the base?

It is NOT more blessed to give than to receive in radio?

When giving long calls you might fade out before you get to your call?

200 meters was meant to use?

At the rate VT's are being manufactured the world's supply of vacuum may soon be exhausted?

The study of radio will drive you nuts sooner or later?

G. R. Hammond, of Olwein, Iowa, sold out 9ZQ and turned in his Special a year ago with the foolish idea he would quit radio. Now he is back again as 9HE. Radio can't be quit!

1BN is now W. A. Jecusio, 47 Day St., Ansonia, Conn.

SSE has moved to Box 1044, Uniontown, Pa.

Ad in "Denver Post": "Wireless receiving set with andiron doctor, cheap". Why use vacuum tubes?

Breathes there a Ham with soul so dead,
Who after reading QST for Feb.

Did not exclaim aloud with joy,
This is my Native Land, "Oh Boy!"

Read 'Em and Weep

SBO of Detroit has been using a single five-watt tube for nine months and on it has handled traffic with 4BF of St. Petersburg, Fla., 9WU of Ellendale, N.D., and is consistently heard by 6XAD.

8HJ of Elmira, N.Y., has been heard very QRK on 10 watts by 6XAD.

4GL (described in February QST) using three five watt tubes has been reported 1700 miles west of Vancouver.

2AYV has been reported on 10 watts over a foot from the phones by 7JS at Anacortes, Wash., using one tube.

5ZA uses two fifty watt tubes, one as

oscillator and one as modulator, and has been reported on phone very loud in Canada, New Jersey, Virginia, Minnesota, New York, and many other places 1,000 to 1,800 miles distant.

6ZE has again been copied in Hawaii, this time with eight-tenths of an ampere from two five-watt tubes.

6ZZ has been heard on one tube, one wire aerial, and one-circuit tuner at Watertown, Mass., also at 1BWD at Calais, Me.

6PT on five watts and 6KA on C.W. and spark have been heard QSA on one tube by 8FT.

8SP of Fairmont, W. Va., using 10⁰⁰ watts C.W. has been copied by 6AME. Riverbank, Calif., and 7ZS, Pullman, Wash.

4CO has been reported by Canadians 5CN and 9BD, both of Vancouver, B. C., and has heard 6XAD, 6ZZ, and 6ATG.

8AGZ sends us a list of 34 Pacific Coast stations who have heard him.

8AGO of Pittsburgh reports working 6BO for a half hour on fifteen watts, very QRK and slight QSS.

The statement made in the January QST concerning the first time a First District station had heard a Sixth District station has caused considerable comment and incidentally has brought in a lot of good records. Arthur E. Ericson at Beverly, Mass., reports that he has heard 6KA and 6ALE at least twice a month, confirming all reception, previous to that mentioned in QST.

In this day and age of everyone getting interested in radio we find the best "experts" behind the counter selling tuners in department and hardware stores. The following is quoted from a circular letter of a large concern: "—capacity up to 400 meter wave length on one battery and higher with two batteries." Also in "The Wireless Man" by F. A. Collins, "The sending key is similar to that of the telegraph, except that it is unusually large and made entirely of wood... At a signal the powerful dynamos are released and the whirr and rush of the machinery suddenly fills the air. As the wooden key is pressed the thundering report of the spark stuns one's ears...."

Wot tha Dosh Dat!

Two hams were testing out a VT.

First Ham: "The first test we are going to run will tell whether it is a stable tube or not."

Second Ham: "How does a stable tube act? Hey?"

First Ham: "It makes a hoarse noise in the phones."

Word has reached us that our fellow amateur William R. Klorig of 4404 W. 16th St., Chicago, passed away on Dec. 29th. He had many friends among radio men in Chicago and those outside may re-

(Concluded on page 54)

With Our Radiophone Listeners

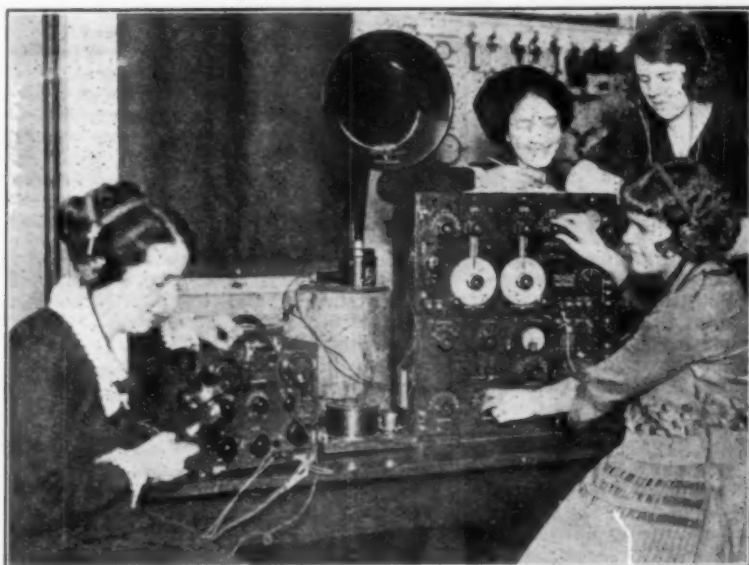
The following is the revised schedule of the Amrad station WGI (formerly 1XE) at Medford Hillside, Mass., wave length 350 meters: Police reports nightly at 7:55 p.m. followed by sermons and music on Sunday, business reports on Monday, bedtime stories for children on Tuesday and Thursday, special music on Wednesday, code practice on Friday, and news on Saturday.

The University of Wisconsin, call WHA, has been a prominent pioneer in the middle-west broadcasting, doing it solely from the amateur standpoint. Daily, except Sunday, from 12 noon to 12:25 the market report and weather forecast is sent by 4 K.W. spark on a wave of 485 meters. This is

stores entering the broadcasting field. In Philadelphia we have WFI—Strawbridge & Clothier, WIP—Gimbel's, WOO—Wanamaker's, as well as WGL—T. F. J. Howlett, ex-3AWL.

The Doubleday-Hill Electric Co., of Washington, D. C., wish to announce that their new station WMU will put on a program every afternoon from 4:30 to 5:30 and also Thursday and Friday from 7:30 to 8:30.

The Atlantic (Ga.) Journal's station WSB broadcasts concerts on 360 meters and news bulletins, market reports, and weather reports on 485 meters.



—Photo by Underwood & Underwood

RADCLIFFE COLLEGE GIRLS OPERATE NEW RADIO STATION—These students are sending messages to their parents in various parts of the country by radiophone from Radcliffe College, Cambridge, Mass. Miss Eleanor Brennan is shown seated at the right, "tuning in." At the left, speaking into the transmitter, is Miss Katherine Miller of Salem, Ohio. Standing in the rear is Miss Margaret Cunningham taking down messages and Miss Susanne Dunn, of Erie, Penn., is listening in.

immediately repeated on the same wave by phone, together with special notices and announcements. On Saturdays the complete program for the coming week is given. Time signals are sent at 12:55 p.m. The regular concert is sent on 360 meters Friday evenings from 8 to 8:45, and in addition a lecture on radio subjects is given on the same wave Saturday afternoons at 1 p.m.

We note with interest the department

Broadcast Stations

The Department of Commerce announces the following list of licensed broadcast stations as complete up to March 10th.

All of these stations employ the 360-meter wave for the broadcasting of music, concerts, lectures, etc., and those marked with the asterisk (*) in addition broadcast market or weather reports on 485 meters, the official wave for that class of work.

Owner	Location	Call
Allen, Preston D.	Oakland, Calif.	KZM
American Radio & Research Corp.	Medford Hillside, Mass.	WGI
Atlantic-Pacific Radio Supplies Co.	Oakland, Calif.	KZY
Ramberger, L., & Co.	Newark, N. J.	WCR
Bible Institute of Los Angeles, Inc.	Los Angeles, Calif.	KJS
Church of the Covenant	Washington, D. C.	WDM
City of Chicago	Chicago, Ill.	WBU
Cox, Warren R.	Cleveland, Ohio	WHK
Crosley Mfg. Co.	Cincinnati, Ohio	WLW
DeForest Radio Telep. & Teleg. Co.	New York, N. Y.	WJX
Detroit News, The	Detroit, Mich.	*WWJ
Doubleday-Hill Electric Co.	Pittsburgh, Pa.	KQV
Doron Brothers Electric Co.	Hamilton, Ohio	WRK
Duck Co., Wm. B.	Toledo, Ohio	WHU
Dunn & Co., J. J.	Pasadena, Calif.	KLB
Electric Lighting & Supply Co.	Hollywood, Calif.	KGC
Examiner Printing Co., The	San Francisco, Calif.	KUO
General Electric Co.	Schenectady, N. Y.	WGY
Gilbert Co., A. C.	New Haven, Conn.	WCJ
Gould, C. O.	Stockton, Calif.	KJQ
Hamilton, Mfg. Co.	Indianapolis, Ind.	WLK
Hatfield Electric Co.	Indianapolis, Ind.	WOH
Herrold, Chas. D.	San Jose, Calif.	KQW
Hobrecht, J. C.	Sacramento, Calif.	KVQ
Howlett, Thos. F. J.	Philadelphia, Pa.	WGL
Karlawa Radio Co.	Rock Island, Ill.	*WOC
Kennedy Co., Colin B.	Los Altos, Calif.	KLP
Kluge, Arno A.	Los Angeles, Calif.	KQL
Kraft, Vincent I.	Seattle, Wash.	KJR
Lorden, Edwin L.	San Francisco, Calif.	KGB
Marshall-Gerken Co.	Toledo, Ohio	*WSZ
Metropolitan Utilities District	Omaha, Nebr.	*WOU
Meyberg Co., Leo J.	San Francisco, Calif.	KDN
Meyberg Co., Leo J.	Los Angeles, Calif.	KYJ
Missouri State Marketing Bureau	Jefferson City, Mo.	*WOS
Montgomery Light & Water Power Co.	Montgomery, Ala.	*WGH
Newspaper Printing Co.	Pittsburgh, Pa.	WPB
Northern Radio & Electric Co.	Seattle, Wash.	KFC
Palladium Printing Co.	Richmond, Ind.	*WOZ
Pine Bluff Co., The	Pine Bluff, Ark.	WOK
Pomona Fixture & Wiring Co.	Pomona, Calif.	KGF
Portable Wireless Telephone Co.	Stockton, Calif.	KWG
Precision Equipment Co.	Cincinnati, Ohio	*WMH
Precision Shop, The	Gridley, Calif.	KFU
Radio Construction & Electric Co.	Washington, D. C.	WDW
Radio Corporation of America	Roselle Park, N. J.	WDY
Radio Shop, The	Sunnyvale, Calif.	KJJ
Radio Telephone Shop, The	San Francisco, Calif.	KYY
Reynolds Radio Co.	Denver, Colo.	*KIZ
Rike Kumler Co., The	Dayton, Ohio	*WFO
Rochester Times Union	Rochester, N. Y.	*WHQ
Seeley, Stuart W.	East Lansing, Mich.	*WHW
Service Radio Equipment Co.	Toledo, Ohio	WJK
Ship Owners Radio Service	New York, N. Y.	WDT
Union College	Schenectady, N. Y.	WRL
University of Minnesota	Minneapolis, Minn.	*WLB
University of Wisconsin	Madison, Wis.	*WHA
Warner Bros.	Oakland, Calif.	KLS
Wasner, Louis	Seattle, Wash.	KHQ
Westinghouse Electric & Mfg. Co.	Springfield, Mass.	WBZ
Westinghouse Electric & Mfg. Co.	Chicago, Ill.	KYW
Westinghouse Electric & Mfg. Co.	Newark, N. J.	WJZ
Westinghouse Electric & Mfg. Co.	East Pittsburgh, Pa.	KDKA
Western Radio Electric Co.	Los Angeles, Calif.	KOG
Western Radio Co.	Kansas City, Mo.	*WOQ
White & Boyer	Washington, D. C.	WJH
Wireless Telep. Co. of Hudson County	Jersey City, N. J.	WNO

Practically all of the above stations have concert hours various evenings in the week. We have received many of their schedules, so many in fact that it would completely fill an issue of QST if we tried to print them. Most of the above have printed sheets for distribution, giving the evenings per week of concerts, lectures, news, etc. We therefore suggest that our readers interested write to the prominent stations in their vicinity and ask to be put on the mailing list for the weekly announcements of the coming week's program.

The photo on this page shows the station operated by the Signal Corps at Fort Wood, Bedloes Island, New York Harbor. The broadcast service is sent on 1400 meters with a 3K.W. set every evening from 9 to 9:55 p.m., call letters WYCB. The development of interest among amateurs and the establishment of contact with them by this and other means, will, it is hoped, result among other things in making practicable the building up of a complete radio net of qualified amateur stations who can and will be willing to assist the regular Army radio net in the transmission of official business during emergency or otherwise.

An Appeal!

Have you ever listened in to a concert and heard a lot of funny (?) noises, squeals, howls, etc.? With a good three-

step amplifier and loud-speaker the family may be enjoying a concert when suddenly there will be a roar like a fire siren tearing thru the room that will make you jump. Or it may moan and groan, sending the children scampering to their mother; or render a hair-raising shriek not unlike that of a woman being murdered,—all in the midst of an otherwise beautiful concert or Uncle Wiggily story. Such occurrences happen nightly in most cities.

The trouble is not with your outfit, neither is it due to amateurs sending, in



the strict sense of the word. The trouble is caused by the listeners themselves!

Briefly the action is this: under certain conditions a receiving set may act as a miniature transmitter. Signals from such a set often carry several miles so it is not unnatural that with several such sets in the same block the noise may be terrific. This transmission only happens when the set is oscillating. Single circuit tuners, such as are common on the market for broadcast receiving because of their simplicity of operation, are especially violent in sending out waves.

After adjusting the tuning element of the set it will be noticed that when advancing the "tickler" or "regeneration" control the signals will increase in loudness up to a certain point. At this point there is a click or thud, beyond which the set oscillates and produces waves of its own. This condition is to be guarded against for the reasons stated above—it makes a transmitter out of your receiver.



—Photo by Underwood & Underwood

W. D. Terrell, Uncle Sam's Chief Radio Inspector at the Department of Commerce, who has been simply deluged with work since radio reception became a popular pastime. Mr. Terrell, boss of the amateurs, is known, respected and admired by the entire A.R.R.L.

Broadcasting stations have a "carrier wave" on which the voice and music travel but which is inaudible unless the receiving set is adjusted to the oscillating condition. In tuning slowly with the set oscillating these waves first become audible at a very high pitch and as the tuning knob is slowly



—Pitcher by Underwood & Underwood
Every other magazine has published this picture so we suppose we might as well too. Originally entitled "Send Me a Kiss by Wireless," members of our staff respectfully suggest that the title might be improved—for example, "Radio teLEGraphy versus telephony," or why not "See the Shaft—on the Variometer."

turned the note decreases in pitch until it is so low it is inaudible for a short space, then rises to the higher audibility limit as the rotation is further continued. In this short space where the "carrier wave" is inaudible, music and voice may be picked up, which may or may not be badly distorted. This is just the stunt many of our listeners proceed to do. During this time their receiving sets are sending out waves which almost surely interfere with other listeners.

We do not mean to bring wrath upon such people as we believe not one in a hundred realizes what he is doing. We want you to know for your own information what happens and incidentally to take considerable blame off the shoulders of amateurs who own transmitting stations.

In Canada, England, and several other countries receiving stations are required to be licensed because of the interference it is possible for them to produce. We hope this will not be necessary in this country.

It will not be if the listeners can co-operate as relay amateurs have learned to do in the past.

Do not adjust your receiving set as described above. Keep it in a non-oscillating condition. The "tickler" or "regeneration" (whichever it is called on your set) should be kept well below the oscillating point, for the signals increase enormously when on the edge of oscillation, they will be badly distorted and as a general rule not as understandable. Don't interpret us as meaning weaker signals are clearer. The tuning should be as near perfect as possible so as to be on the exact wave and the most energy utilized. What we mean is, for the clearest and most understandable reproduction, do not "crowd" the signal too much by excess regeneration, and above all, for the sake of your neighbor, do not allow your set to oscillate.

B. W. BENNING

(Concluded from page 46)

and Marine Corps. Graduating from the Naval Radio School at Paris Island, S.C., in June, 1918, he did his share of guard duty just missing going to France as the Armistice was signed. In March, 1919, he was shipped to Port-Au-Prince, Haiti, where he nursed the generators and punched brass at NSC until discharged in October. He returned to Atlanta and stood the commercial exam, erecting station 4BZ in February, 1920. His present ambition as D.M. is to put the East Gulf Division on the top of the traffic percentage column and keep it there.

"STRAYS"

(Concluded from page 50)

member him as in charge of subscriptions to QST at our booth at the National Convention. We deeply mourn his loss.

WOULDN'T IT BE WONDERFUL—

If Henry Ford would buy up all the spark transmitters in the second district and use them for ship moorings?

If First Grade Commercial Operator's tickets could be bought like a dog's license?

If static could be used to charge the storage batteries?



Calls Heard



HEARD DURING MARCH

Unless Otherwise Specified

Amateurs reporting lists are requested to see instructions appearing at the head of this department in previous issues, and to observe the following additional instructions.

(4) In order to distinguish between spark and C.W. stations, list spark stations from 1 to 9 in the usual manner, and then make a second paragraph in identical form listing the C.W. stations.

Heard By 6NW While Operating Str. "WTT"

565 miles south of Ketchikan, Alaska, Mar. 1: Can.: 5AZ, 5DA, 5FE, 5NA, 9BD. U.S.: 6AJR, 6BIU, 6EA, 6FH, 6HY, 6IB, 6IC, 6MZ, 6OG, 6OL, 6PO, 6WO, 6VK, 6VX, 6ZU, 7BH, 7GJ, 7KE, 7LO, 7NZ, 7WG, 7YA.

300 miles south Ketchikan, Mar. 2: 6AGF, 6AJR, 6EX, 6IC, 6TU, 6VX, 6ZX.

38 miles south Ketchikan, Mar. 3: 7YA, 7YL, 7ZM.

20 miles south Ketchikan, Mar. 4: 7HD, 7KS.

Heard by Opr. Mexican S.S. "Mexico"

At Guaymas, Sonora, Mexico: 5BI, 5BY, 5EH, 5EW, 5FA, 5HK, 5IF, 5IQ, 5IR, 5KP, 5LB, 5NH, 5NS, 5OF, 5QT, 5RA, 5TD, 5TG, 5VO, 5WC, 5XT, 5XU, 5YG, 5ZU, 5ZW, 5ZAD, 5ZAF, 5ZAG, 6DA, 6GR, 6GS, 6KC, 6LC, 6OL, 6QR, 6ZX, 6ZZ, 6AAH, 6AAK, 6AAW, 6ADA, 6AED, 6AEH, 6AMN, 6ASV, 6AUD, 6AVR, 6BGH, 6AEG, 6YAL, 6GT, 6OD, 6UK, 6AJH, 6APP, 6AOE.

At LaPaz, Lower Calif.: 6AS, 6BG, 6EX, 6GR, 6HH, 6HB, 6LC, 6AFE, 6ALD, 6AWX, 6BGH, 6ZAL, 9BSD.

At Mazatlan, Sinaloa: 5AE, 5AL, 5BY, 5HK, 5IF, 5IQ, 5IS, 5JI, 5QQ, 5XB, 5XU, 6HY, 6KC, 6LC, 6OL, 6ZR, 6ZU, 6ZX, 6AEH, 6APP, 6AMN, 9DZE.

At San Blas, Nayarit: 5IQ, 5JI, 5NK, 5QS, 5XB, 5XD, 5XI, 5XU, 5XG, 6EN, 6JI, 6LC, 6AHF, 6AJH, 6AVR.

At Manzanillo: 5JI, 5QA, 5TG, 5XB, 5XU, 5XG, 5ZE, 5ZAA, 9AEG.

Reported by D. L. Cawman, Operator, S.S. "J. R. Gordon. Detector One-Step"

Jan. 22—90 miles east Key West. Spk.: 2FP, 3ACE, 3AJD, 4BQ, 4DZ, 4GN, 5ZAB, 5ZAG, 5XU, 8YM. C.W.: 1QN, 3BEC, 3BLF, 3ZB, 9ARK.

Jan. 23, 200 miles east Miami. Spk.: 2FP, 2JU, 4BC, 4GN, 9YC, 9APS, 4ZC, 5YL. C.W.: 1IV, 1QN, 2AVU, 4BY, 5EK, 8WA, 8AXK, 8BOX, 8BRL, 9ARK.

Jan. 24, 450 miles east Miami: Spk.: 2FP, 2DR, 2OQ, 2OM, 2BJO, 3FB, 3AHK, 3AJD, 4BC, 4DH, 4DZ, 4BF, 5AA, 5NB, 5XU, 8UC, 8XE. C.W.: 1ARY, 2NZ, 3BA, 3DH, 3AJD, 3ZO, 8ADG, 9BLO.

Jan. 25, 680 miles east Miami: Spk.: 1RV, 2FP, 2OM, 3FB, 3HJ, 3ACE, 3AUW, 4EA, 4AU, 4DZ, 8AJW, 8BHD, 8AFD, 8XE. C.W.: 1BKQ, 2AAB, 2AWK, 3DH, 3FS, 3AQH, 4GL, 5FV, 8AQV, 9NX, 9AJA.

Jan. 26, 850 miles east Miami: Spk.: 1HO, 1APO, 1BQO, 2BM, 2FP, 2OM, 3ARM, 4EA, 4DZ. C.W.: 2DK, 2AAB, 2AUV, 2BRB, 3AHK, 3BEC, 3BLF, 3AQR, 8NI, 8WY, 1BDK.

Jan. 27, 900 miles east Miami: Spk.: 2OM, 2ARY, 1XM, 3FB, 4EA. C.W.: 3AHK, 4BK, 5FV. Heavy QRN.

Jan. 28, 1150 miles southeast New York: 1UN on C.W. Very heavy QRN.

Jan. 31, 1687 miles southeast New York: Spark, none. C.W.: 1XM, 2FP, 8BUM.

Feb. 2, 2100 miles southeast New York: No sparks. C.W.: DF1, 1XM.

March 5th on return trip, 2450 miles southeast N. Y. C.: Spark, 2EL, 2JZ, 1CZ, 1BDT (copied complete msg fm 1BDT). C.W.: 1XM, 2AWL, 2XQ, 4BY, 8XV, 9KP (3000 miles).

Mar. 6, 2230 mi. S.E. N. Y. C.: No sparks. C.W.: 2NZ, 2AWL.

Mar. 7, 2100 mi. S.E. No sparks. C.W.: 1XM, 3BA, 4BQ, 4BY.

Mar. 11, 1400 mi. S.E. N. Y. C., 1AKG on spark; 2NZ, NOF, C.W.

Mar. 12, 1250 mi. S.E. N. Y. C. Spk.: 2TS, 3FB, C.W.: 1XM, 1ZE, 2BML, 4BY, 4GL, 8ADG.

Mar. 13, 980 miles southeast New York: Spk.: 2EL, 1CJA, 1LF, 1COK, 2TS, 2OM, 2AGA, 3FB, 4DZ, 8XE. C.W.: 1BAS, 2BEH.

1VT-1BWD, Calais, Maine

C.W.—1ADL, 1AFV, 1AIP, 1AJF, 1AJP, 1AKG, 1AKQ, 1AKR, 1ARY, (1ASF), 1AWP, (1AZW), 1AZX, 1BAS, 1BBW, 1BCF, 1BDC, 1BDE, (1BDI), 1BEA, (1BEP), 1BH, 1BKO, (1BKQ), 1BKR, 1BLE, 1BOC, (1BQE), 1BQI, 1BRQ, 1BSD, 1BTL, 1BUA, 1BUB, (1BWJ), 1BYX, 1CAK, 1CGE, 1CGS, 1CIK, 1CIT, 1CIV, (1CK), 1CLA, (1CMK), 1COD, 1CZ, 1EZ, 1FD, 1II, 1ON, 1PR, 1PT, 1QP, 1UN, 1XM, (1YK), 1ZE, 2AAB, 2AAG, 2ABZ, 2AJA, 2AJF, 2AWF, 2AWK, (2AYV), 2BA, 2BAK, 2BEA, 2BGM, 2BLP, 2BML, 2BNZ, 2BQD, 2BTJ, 2BTW, 2BUM, 2CBW, 2CBY, 2EH, 2FP, 2NZ, 2OF, 2SQ, 2UD, 2UF, 2VA, 2VH, 2XQ, 2ZK, (3ADX), 3AJD, 3AJU, 3AMW, 3ANJ, 3ANY, 3APA, 3APD, 3AQR, 3BAG, 3BEC, 3BFU, 3BG, 3BHL, 3BNU, 3BP, 3BQ, 3BTK, 3BUQ, 3BUV, 3CG, 3CZ, 3FS, 3HG, 3IZ, (3JJ), 3KM, 3LR, 3NH, 3QZ, 3RW, 3SY, (3TA), 3XL, 3ZO, 3ZY, 3ZZ, 4BHL, 4BY, 4GL, 4KM, 4ZC, 4ZE, 5ZA, 8ACF, 8ACZ, 8ADG, 8ADZ, 8ACK, 8AGV, 8AGZ, 8AIM, 8AIU, 8AM, 8AMK, 8AMN, 8AQQ, 8ANR, 8APT, 8AQF, 8ARK, 8ASG, 8AVD, 8AUH, 8AWM, 8AWN, 8AWP, 8AWX, 8AXK, 8BDU, 8BEF, 8BFX, 8BK, 8BLJ, 8BO, 8BUQ, (8CBJ), 8CFS, 8CFP, 8CKM, 8CKO, 8DV, 8HM, 8IQ, 8JO, 8KA, 8KS, (8NB), (8OZ), 8PL, 8QR, 8QZ, 8RW, 8SE, 8SP, (8TB), 8UK, 8VY, 8WE, 8XE, 8XV, 8ZAE, 9AAP, 9AAV, 9AAV, 9AJA, 9ARK, 9AXF, 9BSG, 9BWU, 9CEP, 9DF, 9IO, 9VY, 9WC, 9WE, 9XI.

Spark—1ARY, 1AW, 1BDT, (1BHO), (1BJC), 1BJZ, 1BQA, 1BRQ, 1CHJ, 1CNI, 1GN, 1LZ, 1SN, 1XM, 2BPF, 2JZ, 2OM, 2PV, 3GN, 8BSS, 8ADG, 8XE.

1BOE, Southport, Conn.

Spark—1AA, 1ABZ, 1ADL, 1AKH, 1AJP, 1AKG, 1APO, 1AQO, 1ARY, (1AVW), 1AYQ, 1AZT, 1BCF, 1BDT, (1BGC), (1BGW), 1BJE, (1BKQ), (1BM), 1BMT, 1POQ, (1BQC), 1BQL, 1BRQ, 1BSD, 1BSZ, 1BVB, 1BVH, 1BYT, 1CIL, 1CJA, 1CK, (1CM), 1CNM, 1COK, (1CSP), 1CUS, 1CZ, 1FW, 1GM, 1HO, 1JT, 1OZ, 1RX, 1SN, 1UJ, 1WQ, 1YB, 2ABM, 2ACU, 2ACY, 2AGA, 2AHU, 2AJE, 2AL, 2AWF, 2AXK, 2BFS, 2BFX, 2BJO, 2BK, 2BO, 2BRS, 2BY, (2BRZV), 2CT, (2DI), 2DO, 2DX, (2EL), 2FP, 2GK, 2HJ, 2IG, 2JZ, 2NZ, 2OM, 2OX, 2PF, 2RG, (2RM), 2SH, (2TS), 2TU, (2WB), 2WV, 2XK, 3AJD, 3AN, 3ARM, 3ARN, (3FB), 3FP, 3GX, 3GZ, 3NB, 3OU, 3YV, 4AS, (4BC), 4DQ, 4DZ, (4EA), 4GN, 5XA, 8AFA, 8AFB, 8AFD, 8AFG, 8AHH, 8AOT, 8APB, 8ARD, 8AVT, 8AVY, 8XY, 8AYN, 8BAZ, 8BCO, 8BEP, 8BSY, 8CH, 8EO, 8FI, 8FT, 8HG, 8HY, 8KG, 8LB, 8LH, 8NZ, 8PL, 8PQ, (8RQ), 8SP, 8TY, 8UC, 8WC, 8XE, 8YV, 8ZN, 8ZP, 9AAP.

9AGR, 9AIR, 9AZE, 9DCX, 9RC, 9UH, 9UU, 9ZJ.
Can. 3BP, 3FO, 3GE, 3GN, 3JL, 3KG.

C.W.—1ABB, 1ABY, 1ADL, 1AJP, 1AOL, 1AWB, 1AZW, 1BDL, 1BEA, 1BGF, 1BKP, 1BQE, 1BSD, 1BUA, 1BVA, 1BWJ, 1BYX, 1CAC, 1CGS, 1CIK, 1CJZ, 1FF, 1IL, 1IV, 1NE, 1ON, 1OZ, 1QP, 1RD, 1RZ, 1SQ, 1UJ, 1VQ, 1XM, 2AAB, 2ABZ, 2AEQ, 2AFP, 2AJA, 2AJF, 2AJR, 2AKO, 2ANZ, 2AQU, 2ARO, 2ASH, 2AVU, 2AWL, 2AWS, 2AYV, 2AZZ, 2BCF, 2BDM, 2BEA, 2BEB, 2BEH, 2BFF, 2BFX, 2BFZ, 2BGA, 2BGM, 2BLP, 2BML, 2BMR, 2BND, 2BNH, 2BNZ, 2BPD, 2BQA, 2BQU, 2BQW, 2BRB, 2BSC, 2BTJ, 2BUA, 2BUM, 2BYW, 2BZV, 2CAH, 2CBT, 2CBW, 2CCD, 2CEC, 2CFA, 2CFI, 2CFT, 2CFY, 2CHL, 2CIM, 2CIZ, 2CRO, 2DK, 2EH, 2FC, 2FD, 2FF, 2FZ, 2KP, 2KU, 2KV, 2LH, 2NZ, 2OF, 2RY, 2SC, 2SQ, 2UJ, 2VA, 2VC, 2VH, 2WR, 2ZK, 2ZL, 3AAE, 3AAG, 3ALN, 3AQR, 3BA, 3BAG, 3BHL, 3BIJ, 3BIY, 3BLF, 3CA, 3CM, 3IL, 3LR, 3MO, 3NH, 3QZ, 3RF, 3SQ, 3ZO, 3ZY, 3ZZ, 4AS, 4BF, 4BY, 4DC, 4EH, 4GL, 4GU, 4ID, 4IL, 4LP, 4YA, 4ZC, 4ZE, 5AAM, 5FV, 5IF, 5KU, 5ABV, 5ADG, 5AGO, 5AGZ, 5AHK, 5AJT, 5AJV, 5ALB, 5AMF, 5AMM, 5ANC, 5AQF, 5AQV, 5AQZ, 5ARK, 5ARW, 5ATR, 5AWM, 5AWP, 5AWR, 5AXC, 5BBD, 5BCL, 5BDO, 5BDU, 5BEX, 5BFX, 5BLT, 5BNY, 5BOX, 5BRL, 5BSS, 5BZH, 5CAZ, 5CBJ, 5CFS, 5CGY, 5CLD, 5CNA, 5CNS, 5COO, 5DV, 5GE, 5HM, 5IQ, 5LB, 5QZ, 5STB, 5UK, 5VY, 5WR, 5ZAE, 5ZM, 5ZX, 5ZZ, 9AAV, 9ARK, 9ARK, 9ATA, 9BRL, 9DAX, 9GC, 9KP, 9UH, 9XI.

1BPR, Cambridge, Mass.—All C.W.

1FO, 1IL, 1ON, 1QP, 1RZ, 1XZ, 1YK, 1ZE, 1ADL, 1ARL, 1AWB, 1AZW, 1AZX, 1BEA, 1BEP, 1BES, 1BGF, 1BKP, 1BRQ, 1BSD, 1BUA, 1CAK, 1CGS, 1CIK, 1CJH, 2FD, 2FZ, 2KP, 2KU, 2NZ, 2OF, 2PZ, 2SQ, 2TP, 2VA, 2VC, 2VH, 2WR, 2WT, 2XQ, 2ZK, 2ZS, 2AAB, 2ABZ, 2AFP, 2AJF, 2AJR, 2AQF, 2AQU, 2AWF, 2AWL, 2AWS, 2AYV, 2AZZ, 2BAK, 2BCF, 2BEA, 2BEB, 2BEH, 2BEM, 2BFQ, 2BFX, 2BGL, 2BGM, 2BML, 2BNC, 2BNZ, 2BRC, 2BTJ, 2BUM, 2BXD, 2BYW, 2CCD, 2CCU, 2CDA, 2CFA, 2CGQ, 2BA, 2BG, 2BZ, 3AC, 3CG, 3CM, 3FS, 3HG, 3HJ, 3IZ, 3JH, 3KM, 3LR, 3NO, 3PB, 3QV, 3QZ, 3RF, 3RW, 3VW, 3XL, 3ZO, 3ZY, 3ZZ, 3AAD, 3AAY, 3ADT, 3ADX, 3ALN, 3ANJ, 3APS, 3APQ, 3AQH, 3AQR, 3BAG, 3BFU, 3BHL, 3BIY, 3BKS, 3XAA, 4AS, 4BQ, 4BY, 4DC, 4FT, 4GL, 4ID, 4IL, 4LP, 4YA, 4ZC, 4ZE, 5FV, 5IF, 5BK, 5BO, 5BU, 5DV, 5GE, 5HJ, 5HT, 5IQ, 5JL, 5JU, 5KH, 5KS, 5LX, 5MP, 5OS, 5QM, 5QZ, 5RQ, 5SE, 5SP, 5TB, 5UK, 5VY, 5WR, 5XE, 5XV, 5ZX, 5ACF, 5ADG (dalite), 5AGO, 5AGZ, 5AIM, 5AIO, 5AMK, 5AMM, 5AND, 5ANJ, 5AQA, 5AOG, 5AQF, 5AQV, 5ARK, 5ARW, 5AVD, 5AWM, 5AWP, 5AWR, 5AXC, 5AXK, 5BBD, 5BBK, 5BCL, 5BCL, 5BDO, 5BDU, 5BEP, 5BFX, 5BLT, 5BNJ, 5BRL, 5BSO, 5BSS, 5BTO, 5BUQ, 5BZH, 5BZY, 5CAZ, 5CBJ, 5CFF, 5CFS, 5CKM, 5CLD, 5CNS, 5COO, 5YAA, 5ZAE (dalite) 9EI, 9FZ, 9HH, 9HW, 9IO, 9IZ, 9KP, 9UC, 9UH, 9WA, 9ZL, 9AAP, 9AAS, 9AAV, 9AAY, 9AJA, 9ARK, 9ARK, 9AYH, 9BRL, 9BSG, 9DAM, 9DAX, 9DYN, Canadian 2BG, 3BP, 3CZ, 9AL, 9AW.

F. G. Sands, Danbury, Conn.

C.W.—1ADL, 1AJP, 1ARY, 1AVR, 1AWB, 1AZW, 1AZX, 1BAS, 1BEA, 1BEP, 1BES, 1BDC, 1BGF, 1BGF, 1BKP, 1BKQ, 1BKR, 1BLE, 1BSD, 1BTL, 1BUA, 1BWJ, 1BYX, 1CAK, 1CGS, 1CIK, 1CIV, 1CJO, 1CJZ, 1CK, 1CLL, 1COD, 1CPZ, 1CRH, 1DAC, 1EZ, 1FF, 1IL, 1IV, 1IJ, 1OW, 1ON, 1QN, 1QP, 1RU, 1RZ, 1TS, 1UJ, 1VJ, 1VG, 1VT, 1XM, 1ZE, 2AAB, 2AAZ, 2ADL, 2ACH, 2AFP, 2AJF, 2AJW, 2AQU, 2AVU, 2AWF, 2AWJ, 2AWL, 2AYV, 2BAK, 2BCA, 2BEA, 2BEM, 2BEM, 2BFG, 2BGL, 2BGM, 2BML, 2BNZ, 2BPD, 2BQA, 2BQU, 2BQW, 2BRB, 2BSC, 2BTJ, 2BUA, 2BUM, 2BYW, 2CCD, 2CCU, 2CDA, 2CEC, 2CGQ, 2EH, 2FD, 2FF, 2FZ, 2KP, 2KU, 2KV, 2NZ, 2OF, 2PZ, 2SQ, 2TP, 2VA, 2VC, 2VH, 2WR, 2WT, 2XQ, 2ZK, 2ZS, 2AAB, 2ABZ, 2AFP, 2AJF, 2AJR, 2AQF, 2AQU, 2AWF, 2AWL, 2AWS, 2AYV, 2AZZ, 2BAK, 2BCF, 2BEA, 2BEB, 2BEH, 2BEM, 2BFQ, 2BFX, 2BGL, 2BGM, 2BML, 2BNC, 2BNZ, 2BRC, 2BTJ, 2BUM, 2BXD, 2BYW, 2CCD, 2CCU, 2CDA, 2CFA, 2CGQ, 2BA, 2BG, 2BZ, 3AC, 3CG, 3CM, 3FS, 3HG, 3HJ, 3IZ, 3JH, 3KM, 3LR, 3NO, 3PB, 3QV, 3QZ, 3RF, 3RW, 3VW, 3XL, 3ZO, 3ZY, 3ZZ, 3AAD, 3AAY, 3ADT, 3ADX, 3ALN, 3ANJ, 3APS, 3APQ, 3AQH, 3AQR, 3BAG, 3BFU, 3BHL, 3BIY, 3BKS, 3XAA, 4AS, 4BQ, 4BY, 4DC, 4FT, 4GL, 4ID, 4IL, 4LP, 4YA, 4ZC, 4ZE, 5FV, 5IF, 5BK, 5BO, 5BU, 5DV, 5GE, 5HJ, 5HT, 5IQ, 5JL, 5JU, 5KH, 5KS, 5LX, 5MP, 5OS, 5QM, 5QZ, 5RQ, 5SE, 5SP, 5TB, 5UK, 5VY, 5WR, 5XE, 5XV, 5ZX, 5ACF, 5ADG (dalite), 5AGO, 5AGZ, 5AIM, 5AIO, 5AMK, 5AMM, 5AND, 5ANJ, 5AQA, 5AOG, 5AQF, 5AQV, 5ARK, 5ARW, 5AVD, 5AWM, 5AWP, 5AWR, 5AXC, 5AXK, 5BBD, 5BBK, 5BCL, 5BCL, 5BDO, 5BDU, 5BEP, 5BFX, 5BLT, 5BNJ, 5BRL, 5BSO, 5BSS, 5BTO, 5BUQ, 5BZH, 5BZY, 5CAZ, 5CBJ, 5CFF, 5CFS, 5CKM, 5CLD, 5CNS, 5COO, 5YAA, 5ZAE (dalite) 9EI, 9FZ, 9HH, 9HW, 9IO, 9IZ, 9KP, 9UC, 9UH, 9WA, 9ZL, 9AAP, 9AAS, 9AAV, 9AAY, 9AJA, 9ARK, 9ARK, 9AYH, 9BRL, 9BSG, 9DAM, 9DAX, 9DYN, Canadian 2BG, 3BP, 3CZ, 9AL, 9AW.

5AJT, 5AJV, 5AND, 5ANJ, 5ANR, 5AOO, 5ARK, 5AVD, 5AWM, 5AWP, 5AZZ, 5BDR, 5BDU, 5BEX, 5BIZ, 5BOX, 5BUG, 5BXA, 5CBJ, 5DV, 5EV, 5GE, 5HM, 5JS, 5NV, 5OS, 5OZ, 5QY, 5SE, 5SP, 5TB, 5UK, 5ZAE, 5AAY, 5AJA, 5ARK, 5BLO, 5BRL, 5IO, 5KP, 5PF.

Spark—1ADL, 1APO, 1ARM, 1ARY, 1AW, 1BEP, 1BOE, 1BOP, 1BOQ, 1BQA, 1BVH, 1CGS, 1CK, 1COK, 1HO, 2ABM, 2AHU, 2AJE, 2BJO, 2CKF, 2CT, 2EL, 2FP, 2GP, 2GX, 2JZ, 2AAB, 2ACM, 2AIC, 2AJD, 2AK, 2ALD, 2ALN, 2ARM, 2GN, 2GX, 2JJD, 2JW, 2NB, 2OU, 2RW, 2US, 2VW, 2YP, 2YV, 2AHH, 2AHS, 2BRL, 2CFS, 2XE, 2ZA, 2ZP.

2BLL, Paterson, N. J.

C.W.—1ABB, 1AJP, 1ANY, 1ARY, 1ARV, 1AWF, 1BDK, 1BEP, 1BKQ, 1BKO, 1BMO, 1BUA, 1CAK, 1COD, 1XM, 1XX, 3AAY, 3ABF, 3AJD, 3ALN, 3AQH, 3AZR, 3BAG, 3BGL, 3BHL, 3BLF, 3BNU, 3BZ, 3CC, 3CM, 3GN, 3IL, 3LL, 3MN, 3QZ, 3RW, 3VA, 3VY, 3ZO, 3ZY, 3ZZ, 4BQ, 4BY, 4DC, 4FT, 4GL, 4PT, 4ZC, 4ZY, 5AN, 5UU, 5AGK, 5AGN, 5AGO, 5AGZ, 5AIM, 5AJN, 5AJP, 5ANR, 5AOA, 5AOO, 5APT, 5AQF, 5ARU, 5AWM, 5AWP, 5AXC, 5AXR, 5AZV, 5BAZ, 5BBD, 5BBK, 5BBO, 5BCL, 5BDO, 5BEF, 5BET, 5BFX, 5BK, 5BNV, 5BO, 5BOX, 5BR, 5RL, 5BUG, 5BY, 5BYE, 5BZC, 5CKO, 5GE, 5IB, 5IK, 5IP, 5JU, 5LW, 5MP, 5PT, 5PX, 5QZ, 5RY, 5SE, 5SM, 5SP, 5UK, 5WO, 5WR, 5WY, 5XK, 5XV, 5XY, 5ZAE, 5ZN, 5ZV, 9AAY, 9AAV, 9ARK, 9AWA, 9BDU, 9BMM, 9BRL, 9EI, 9IO, 9KP, 9OU, 9ZAC, 9ZJ, 9ZL, Can. 3BP.

Spark—1ARY, 3AWD, 3NB, 3ARD, 3BSY, 3RQ, 3XE.

2AWF, Albany N. Y.

Spark: 1AA, 1ADL, 1BHR, 1BJS, 1BOP, 1BOQ, 1BQA, 1BQL, 1BRQ, 1BYG, 1COK, 1GM, 1HO, 1QO, 1RV, 1SN, 1UB, 1UL, 1WQ, 2AAF, 2AIM, 2AJE, 2ARY, 2BJO, 2DA, 2DI, 2EL, 2JZ, 2OM, 2RM, 2TS, 2WB, 2ACM, 2AGT, 2AJD, 2AK, 2AN, 2ANJ, 2AQZ, 2ARM, 2BDU, 2BKQ, 2BEH, 2FB, 2FP, 2HJ, 2OU, 2QW, 2JA, 2UD, 2YK, 2BC, 2CX, 2EA, 2FD, 2AAP, 2ACF, 2AFB, 2AFD, 2AFG, 2AAH, 2AJT, 2ANW, 2APB, 2AU, 2AXO, 2BAH, 2BCO, 2BEP, 2BFH, 2BSS, 2BSY, 2BUN, 2DY, 2EO, 2EV, 2EW, 2FT, 2LB, 2LH, 2PL, 2OE, 2QC, 2RQ, 2WO, 2WZ, 2XE, 2YN, 2AAP, 2AAW, 2ACB, 2AGR, 2AIR, 2DCX, 2DFX, 2DIO, 2DWP, 2GX, 2KI, 2MC, 2UH, 2YB, 2YQ, 2ZJ, Can. 3BP, 3FO, 3GE, 3JL.

C.W.—1ADL, 1AJP, 1AMQ, 1AWB, 1AZW, 1BGF, 1BVS, 1BWJ, 1CAK, 1CGS, 1CJZ, 1CKP, 1CLN, 1CMK, 1RZ, 1UJ, 1ZE, 2AAB, 2AFP, 2AJD, 2AJE, 2AKO, 2ALR, 2AMQ, 2AZO, 2AZZ, 2BBB, 2BEM, 2BGI, 2BML, 2BND, 2BSC, 2BUM, 2CAT, 2CBG, 2CFI, 2EH, 2FF, 2FQ, 2KP, 2RC, 2VH, 2WI, 2WT, 3AAD, 3AAE, 3ADT, 3ANJ, 3ANQ, 3APA, 3APQ, 3ASO, 3AWA, 3BFQ, 3BG, 3BHL, 3BIJ, 3BIY, 3CC, 3CG, 3CM, 3FS, 3HJ, 3IZ, 3KM, 3RI, 3US, 3VW, 3ZN, 3ZO, 4BQ, 4BY, 4CD, 4CO, 4DC, 4EH, 4FT, 4GL, 4IL, 4LP, 4YA, 4ZC, 4ZE, 5AAM, 5DA, 5EK, 5FV, 5KU, 5ACF, 5AJT, 5ALB, 5ALV, 5AMD, 5AQF, 5AQV, 5ARW, 5AVH, 5AWY, 5AWZ, 5BDU, 5BEX, 5BK, 5BOX, 5BRL, 5BTO, 5BUN, 5BZG, 5BZH, 5CFS, 5CKO, 5COO, 5DV, 5HJ, 5IQ, 5OW, 5PN, 5QZ, 5RQ, 5VY, 5WR, 5XAE, 5XE, 5ZG, 5ZZ, 9AAP, 9AAS, 9AAV, 9AJA, 9AKD, 9ALH, 9ASL, 9BED, 9BRL, 9DAX, 9EI, 9KP, 9PF, 9ZL, Can. 2BG, 3BP.

2AVE, Jamaica, L. I.

C.W.—1IL, 1ON, 1PR, 1RZ, 1VQ, 1XM, 1YK, 1AIP, 1AJP, 1AJS, 1ANR, 1ARY, 1ASF, 1AVR, 1BQE, 1CAC, 1CAK, 1CJH, 2AB, 2FC, 2RY, 2AAB, 2AEH, 2AEQ, 2AEQ, 2AJF, 2AMX, 2ATJ, 2AVU, 2BNC, 2BQW, 2BRM, 2BSC, 2BUQ, 2BWA, 2BWA, 2BWW, 2CDW, 2BA, 2BG, 2CA, 2FS, 2GH, 2HG, 2IL, 2LR, 2QZ, 2RP, 2ZY, 3AJD, 3ALE, 3ALN, 3ANJ, 3APQ, 3AQH, 3AQR, 3BAG, 3BEC, 3BFU, 3BHL, 3BOF, 3BQV, 3BUV, 4BF, 4BQ, 4BY, 4CO, 4DC, 4GL, 4JH, 4KK, 4XD, 4ZC, 5FV, 5BK, 5DV, 5HJ, 5HM, 5HT, 5LX, 5NB, 5OS, 5OW, 5QB, 5QM, 5QZ, 5SP, 5VY, 5XE, 5XV, 5ZE, 5ZY, 5ACF, 5ADG, 5AGO, 5AGZ, 5AIO, 5ALB, 5ANC, 5AOA, 5AQV, 5ARK, 5ARW, 5AWP, 5AXC, 5AXK, 5BBB, 5BBK, 5BCL, 5BDB.

8BDU, 8BQV, 8BSS, 8BZH, 8CAZ, 8CFS, 8ZAE, 9DV, 9EI, 9KP, 9PS, 9SO, 9WA, 9WQ, 9ZL, 9AA, 9AJA, 9ASL, 9BRL, 9BSG, Can. 9AL.

Spark—1HK, 1ARY, 1AZK, (2DO), (2ALB), (2AQN), (2ASU), (2AU), (2BAU), (2BCK), (2CEJ), (2CGT), (2CJS), 3FB, 3GM, 3HJ, 3RW, 3AGT, 3AIC, 3AJD, 4BL, 4BS, 4EA, 8EW, 8FT, 8MZ, 8RQ, 8UC, 8VW, 8VY, 8WD, 8WO, 8XE, 8ZE, 8AFG, 8AHS, 8AJX, 8ALO, 8ANW, 8AXQ, 8AXX, 8AXY, 8AYN, 8BCO, 8BGT, 8BRL, 9OX, 9UH, 9VL, 9AAW, 9ACB, 9AGR, 9AIR, 9AWZ, 9DMJ, 9DZY, Can. 3GN.

2BYA, Schenectady, N. Y.

Spark—1AA, 1ADL, 1AJE, 1APX, 1ARY, 1AV, 1AW, 1AVR, 1BFZ, 1BJS, 1BRQ, 1BWL, 1COK, 1DZ, 1FR, 1GM, 1LZ, 1RU, 1RV, 1SN, 1SW, 1WQ, 2ABM, 2AJE, 2ANM, 2AWF, 2BK, 2BLW, 2BM, 2BYG, 2CHW, 2CIE, 2EL, 2GX, 2OM, 2PV, 2RM, 2SZ, 2TS, 3ABB, 3AJD, 3ARM, 3ARN, 3FB, 3FD, 3HJ, 3OK, 3QW, 3UD, 3UX, 3VW, 3XM, 3ZO, 4BX, 4EA, 8AAV, 8ACF, 8AFA, 8AFB, 8AFG, 8AHH, 8AHS, 8AIW, 8APB, 8ARK, 8AXO, 8BCO, 8BAZ, 8CX, 8EM, 8OD, 8SP, 8XE, 9OX, 9UH, 9ZJ. C.D.—1ADL, 1AFV, 1AJF, 1AJP, 1AMQ, 1APJ, 1ARK, 1ARY, 1AVR, 1ASF, 1AZW, 1BAS, 1BCF, 1BDC, 1BEA, 1BEP, 1BGF, 1BKR, 1BKQ, 1BLE, 1BRQ, 1BQE, 1BSD, 1BSG, 1BUA, 1BWJ, 1CAK, 1CAN, 1CGG, 1CGS, 1CIK, 1CIT, 1CJH, 1CJZ, 1CLN, 1COD, 1CPQ, 1FB, 1IL, 1ON, 1QP, 1PT, 1RD, 1RH, 1RR, 1TS, 1UJ, 1UN, 1XAE fone, 1XM, 1ZE, 2AAB, 2ABQ, 2ADP, 2AGD, 2AGV, 2AAR, 2ADV, 2AJF, 2AJR, 2AKO, 2ARZ, 2AUU, 2AWJ, 2AWL, 2AWS, 2AZZ, 2BA, 2BAK, 2BCF, 2BEA, 2BEH, 2BEM, 2BG, 2BGZ, 2BML, 2BND, 2BNZ, 2BQI, 2BQV, 2BRB, 2BRQ, 2BTJ, 2CCD, 2CCU, 2CFM, 2CGO, 2CZS, 2FZ, 2IG, 2IJ, 2LP, 2OF, 2PZ, 2RD, 2RP, 2SZ, 2VA, 2XI fone, 2XJ fone, 2VH, 2ZK, 2ZO, 2ZS, 3AAD, 3AAG, 3AAY, 3ADT, 3ADY, 3AIG, 3AJD, 3ALN, 3AAG, 3ANY, 3APD, 3ARK, 3AQH, 3AQR, 3AS, 3AZO, 3BAG, 3BEC, 3BFQ, 3BHL, 3BIY, 3BG, 3BNU, 3BP, 3BRW, 3BQF, 3BTK, 3BUL, 3BUR, 3BY, 3BZ, 3CA, 3CC, 3CG, 3CTZ, 3DM, 3FB, 3FR, 3FS, 3GN, 3HB, 3HD, 3HX, 3IL, 3IZ, 3IH, 3LR, 3RC, 3QZ, 3SM, 3TY, 3VH, 3ZO, 3ZW, 3ZY, 4BF, 4BQ, 4BY, 4CC, 4DC, 4DS, 4EH, 4FI, 4GL, 4GX, 4ID, 4IL, 4LP, 4XD, 5AN, 5BM, 5FV, 5KP, 5NZ, 5UU, 5ZA, 8ACF, 8AGO, 8AGZ, 8AIM, 8ANJ, 8AMM, 8AOA, 8AQF, 8AQV, 8AQZ, 8AOC, 8ARD, 8AR, 8AWM, 8AWP, 8AWZ, 8AX, 8AXC, 8AXK, 8BZ, 8BD, 8BDK, 8BDU, 8BCL, 8BDS, 8BEF, 8BFX, 8BL, 8BLT, 8BNI, 8BOX, 8BRC, 8BRL, 8BRS, 8BEF, 8BFX, 8BIL, 8BLT, 8BNI, 8BO, 8BU, 8BZH, 8BZJ, 8BZY, 8BUR, 8BVK, 8BSS, 8BXA, 8BY, 8BZ, 8BZA, 8BZC, 8BZH, 8CAZ, 8CBI, 8CGY, 8CKM, 8CKO, 8CNS, 8DV, 8GE, 8IB, 8IQ, 8JL, 8JS, 8JU, 8IW, 8OS, 8PC, 8RZ, 8QD, 8SP, 8TB, 8TF, 8UK, 8VQ, 8VY, 8PT, 8WR, 8XV, 8ZE, 9AAP, 9AAU, 9AAY, 9AKD, 9ANC, 9ANF, 9APB, 9ARK, 9ASS, 9BLO, 9BRL, 9BSG, 9DYN, 9IO, 9KP, 9LQ, Can. 9AL.

3FM, Philadelphia, Pa.

C.W.—1ON, 1QP, (1XM), 1ZE, (1ARY), 1ASF, 1BAS, (1BKQ), 1BSD, (1BWJ), 1CAK, 1CGS, 1CIK, 1COD, 2EH, 2FF, 2NZ, 2UD, 2VA, 2XQ, 2ZK, 2AJF, (2YV), 2BEA, 2BMA, 2BQD, 2BRB, (2BSC), 2BTJ, (2BW), (3BA), (3EM), (3GH), 3HG, 3IL, 3JJ, 3LR, 3QZ, (3ZO), (3ZY), 3ZZ, (Can. 3BF fone and C.W.), 3AAG, 3AQR, (3ALN), (3BAG), 3BIF, 3BLF, 3BNU, 4BF, 4BQ, (4BY), 4FT, 4GL, 4IL, (4YA), 4ZC, 5RM, 5FV, 5IF, 5XA, 5ZA, 8AM, 8BK, 8BO, 8DV, (8EV), 8GE, 8ICW, 8HJ, 8LX, 8QB, 8QY, 8SP, 8TB, 8UK, 8WL, 8VJ, 8VY, 8XV, 8ZG, 8ADG, 8ADR, (8AGO), 8AGZ, 8AJV, 8ALT, (8AMM), 8AGF, 8AQV, 8ARK, 8AYO, (8AWP), 8AWZ, 8AXC, 8AXK, 8BBL, 8BOX, (8BRL), (8BSS), 8BYE, 8BZH, 8BZJ, 8CAZ, 8CFS, 8CGY, 8CKO, 8ZAE, 9AG, 9DV, 9EI, 9HW, 9HY, 9IO, 9KP, 9UH, 9XM, 9ZL, 9AAV, 9AAY, 9AJA, 9BRK, 9BRL. Spark—1AW, 1GM, 1AKG, 1ARY, 1BHO, 2GK, 2OM, 2SZ, 2AHU, 8EA, 8EW, 8FT, 8OX, 8RQ, 8UC, 8VR, 8XE, 8APD, 8ARD, 8AXC, 8AXY, 8AYN, 8ZAC, 9AAW, 9AGR, 9AWZ, 9ZJ.

3CA, Roanoke, Va.

C.W.—1AJP, 1ANQ, 1AWB, 1AZW, 1BWJ, 1CAC, 1CAK, 1CJZ, 1QP, (1VQ), 1XM, 1ZE, 2ADL, 2AJE,

2AQF, 2AVE, 2AYV, 2AZZ, 2BEA, 2BEB, 2BFX, 2CCD, 2CCU, 2FP, 2NZ, 2VH, 2ZK, 3AAD, 3AAE, 3AAG, 3AAY, 3ADX, (3AEV), (3AJD), (3ALN), 3ANQ, 3ANY, 3ANZ, 3APQ, 3AQH, (3AQR), 3AQS, 3AS, 3BA, 3BFU, (3BG), 3BHL, 3BNQ, 3BRI, (3BZ), 3CAA, 3CC, 3FM, 3FS, 3GG, 3HJ, 3HX, (3JJ), 3KM, 3KU, 3QV, 3QW, (3QZ), 3TA, 3TJ, (3VW), 3XT, 3ZE, 3ZO, 3ZY, 4ABM, (4BQ), 4BY, 4CL, (4CO), 4DC, (4DS), 4EB, 4EH, (4GL), 4GU, 4HB, (4ID), 4IL, 4KC, 4KK, 4LP, 4XD, 4YA, (4ZC), 4ZE, 4YA, (5DA), 5EK, 5FV, 5LA, 5NZ, 5ZA, 8ACF, 8ADG, 8AFD, 8AFZ, 8AGO, 8AGZ, 8AIG, 8AIM, 8AIO, 8AJT, 8AJV, 8ALB, 8AMZ, 8APW, 8AQF, 8AQV, 8AQZ, 8ARK, 8AWD, 8AXM, 8AWZ, (8AXK), 8AXE, 8BAE, 8BCJ, 8BP, (8BDU), 8BEB, 8BEC, 8BED, 8BEF, 8BEX, 8BF, 8BGE, 8BJV, 8EK, 8BLT, (8BO), 8BOX, 8BQC, 8BU, (8BXA), 8BZR, 8CAG, 8CAZ, 8CFS, 8C, 8CHO, 8CKO, 8CLD, (8DV), 8FT, (8GE), 8H, 8IQ, 8LB, 8NI, 8RQ, 8SP, 8UK, 8VJ, 8VY, 8WB, 8XB, 8XE, 8XR, 8ZX, 8ZZ, 9AAS, 9AAP, 9AAX, 9AIR, 9AJA, 9AJH, 9AKA, 9AL, 9AUT, 9AXK, 9AYH, 9BHG, 9BLO, 9BSG, 9DAX, 9DXW, 9DIF, 9DYN, 9IF, 9IL, 9IO, 9KP, 9LE, 9WA, 9ZG, 9ZE, 9ZL, Can. 3BP, 3GN, 9AL.

Spark—2AJE, 3ABB, 3AOV, 3GN, 3QW, 4AU, 4BB, 4CX, (4EA), 4FD, 5HS, 5PY, (5XA), 8AFD, 8AIZ, 8BSY, 8CGZ, 8FT, 8I, 8UC, 8XE, 9BK, 9DSO, 9IP, 9LF, 9MC, 9VL.

3IL, Washington, D. C.

Spark—1AMD, 1AW, 1BWJ, 1BYK, 1BZZ, 2AJE, 2AQI, 2BBL, 2BFF, 2BRC, 2BY, 2GK, 2JL, 2JS, 2UD, 2WC, 3AIC, 3AN, 3ARD, 3BPO, 3EL, 3FB, 3FP, 3HJ, 3OU, 3ZS, 5EK, 8ABY, 8AFP, 8AHH, 8AJD, 8ARD, 8ARK, 8AUV, 8AXY, 8AYV, 8BCO, 8CKM, 8JZ, 8KQE, 8LB, 8QE, 8TF, 8UC, 8UK, 8WD, 8ZW, 9AAW, 9ARD, 8BRZ, 9DCX, 9OX, 9SK, 9SN, 9UH, 9UU, 9YA, 9YAE, 9YC, 9YQ, 9ZJ.

C.W.—1AJP, 1ARY, 1ASF, (1AWB), 1AZW, 1BDT, 1BEP, 1BGF, 1BKQ, 1BSD, 1BTL, 1BUA, 1BWJ, 1CAK, 1CMK, 1IL, 1PT, 1RD, 1UL, (1XM), 1ZE, (2AAB), 2AIC, (2AJF), 2AJW, 2AQU, 2AWF, 2BAK, (2BEA), 2BEH, 2BML, 2BNC, (2BNZ), 2BRC, 2BSC, 2BUM, 2CCD, 2CGQ, 2FAF, 2FD, 2FP, 2FZ, 2KP, 2KU, 2KY, 2NZ, 2WJ, 2VA, 2XQ, 2ZK, 2ZS, 3AAD, 3ADT, 3AJD, 3AJE, 3ANJ, 3APA, 3AQR, 3BEC, 3BFU, 3BGZ, 3BP, (CAN), 3BPK, 3BUR, 3BZ, 3CC, 3CG, 3CM, 3EL, 3EM, (3FS), 3GN (Can.), 3HG, 3KB, 3QZ, 3VW, (3ZO), 5FV, 5HO, 5IF, 5KU, 5LA, 5NZ, 5XAC, 5ZAC, 4AS, 4AZ, 4BF, 4BQ, 4BY, 4CX, 4DC, 4DS, 4EH, 4EU, 4FT, 4GL, 4IL, 4IV, 4LP, 4YA, 4ZC, 4ZE, 6ZZ, 8ACF, (8ADG), 8AGK, 8AGO, 8AGZ, 8AHH, 8AHS, 8AIM, 8AJV, (8ALB), 8ANJ, 8AOO, (8AQV), 8AQZ, 8ARW, 8AWM, 8AWP, 8AWY, 8AXC, 8BCL, (8BDB), 8BDO, 8BDU, 8BEL, 8BFX, 8BK, 8BLT, 8BNI, 8BO, 8BU, 8BZH, 8BZJ, 8BZY, 8DR, 8DV, 8EO, (8EV), 8EW, (8GE), 8IB, 8IQ, 8CAZ, 8CBJ, 8CFS, 8CGY, 8CLW, (8CNS), 8COO, 8JU, 8KH, 8OS, (8OW), 8PC, 8QB, 8QM, 8QZ, 8SE, (8SP), 8UK, 8VY, 8WL, 8WY, 8XE, 8YAA, 8ZAE, 8ZG, 8ZZ, 9AAV, 9ABF, 9AJA, 9AKP, 9AL, (9ARK), 9AXF, 9AYH, 9AYS, 9BDO, 9BRL, 9EI, 9HW, 9IL, 9IO, 9PS, 9RI, 9RZ, 9SO, 9WU, 9ZG, 9ZL.

3ZO, Parkesburg, Pa.—Worked

III, 1XM, 1ADL, 1AZX, 1BDF, 1BGF, 1BKQ, 8ZE, 8AFG, 8AHS, 8AJX, 8ALO, 8ANW, 8AXQ, 1BSD, 1CIK, 1CJZ, 2PZ, 2AYV, 2BWA, 2CEC, 3BA, 3BZ, 3DM, 3EM, 3FM, 3FS, 3HJ, 3IL, 3JW, 3LP, 3QV, 3QW, 3QZ, 3RW, 3UO, 3UX, 3ZN, 3ZS, 3ZY, 3AAD, 3ACS, 3ADZ, 3AIC, 3AJD, 3ALN, 3ANJ, 3AQH, 3AQR, 3ARM, 3ASK, 3AUW, 3AWW, 3BJT, 4BF, 5FV, 5CV, 8LX, 8VY, 8YD, 8ZZ, 8AWP, 8AXY, 8BBK.

4EZ, Jacksonville, Fla.

Spark—1ARY, 1BEP, 1BOE, 2EL, (2FP), (3ARN), (4AS), (4AU), (4BC), (4BI), 4CG, 4CP, (4CX), (4DZ), (4EA), (4FD), (4FP), (4GM), (4GN), 4GU, (4HS), (4IX), 5GL, 5QA, 5SM, (5XA), (5AAB), 8AV, 8IH, 8ARS, (8BAZ), (8BBU), (8BRL), (8BXX), 9BK, 9GX, 9LF, 9OX, 9QM, (9UH), 9VL, (9AGR), 9DCX.

C.W.—1XM, 1AJP, 1BQE, 2FP, 3BZ, 3AJD, 4BK, (4DS), (4JH), 5DA, 5FV, 6KA, 8IO, 8IQ, 9AAS, 9AZH.

9YM, 9ACB, 9AOU, 9AYW, 9ARK, 9BLJ.
C.W.—1UQ, 1ZE, 1ANQ, 1AQJ, 1AJP, 1ARY, 1AWS, 1BKQ, 1BUA, 1CAK, 2BL, 2BP, 2CA, 2SV, 2TG, 2ZK, 2ANY, 2AQH, 2AJE, 2AJW, 2BEA, 2BEB, 2BIU, 2BLJ, 3BL, 3BG, 3BL, 3NH, 3RF, 3AJK, 3AQR, 3BEA, 3BHL, 3BRL, 4BQ, 4BY, 4DC, 4DS, 4ID, 4ZC, 4ZY, 5CH, 5LA, 5WO, 5ZA, 5X, 5BK, 5DU, 5LF, 5LU, 5MG, 5OW, 5SP, 5XE, 5XK, 5ZA, 5ZR, 5ABO, 5AGO, 5ALM, 5AMM, 5ADG, 5AOZ, 5AWP, 5BBB, 5BED, 5BCL, 5BCF, 5BDB, 5BDU, 5BEF, 5BFX, 5BFZ, 5BGH, 5BRL, 5BRM, 5BUN, 5BEZ, 5BZO, 5CAZ, 5CEE, 5CTZ, 5AW, 5EI, 5FQ, 5FZ, 5KP, 5WA, 5WW, 5AAW, 5AJA, 5AJK, 5AKD, 5AKR, 5ANQ, 5AOU, 5ARK, 5AYN, 5AYW, 5AJ, 5BBU, 5BEA, 5BBU, 5BED, 5BLO, 5BRL, 5CRL, 5DKY, 5DYN.

SBIL, Warren, Pa.

C.W.—1ADL, 1AJP, 1ARY, 7AZX, 1BDC, 1BEF, 1BGF, 1BKQ, 1BSD, 1BWJ, 1CA, 1COD, 1EZ, 1ON, 1PR, 1PT, 1QF, 1QF, 1RD, 1XM, 1YK, (2AAB), 2AAT, 2AJF, 2APQ, 2AU, 2AWF, 2AWL, 2AYI, 2AYT, 2BDM, 2BEA, 2BGM, 2BJF, 2BML, (2BNZ), 2BQD, 2BQU, 2BRB, 2BSC, 2BTJ, 2BXP, 2BZU, 2CEC, 2CFL, 2CFT, 2CGO, 2EH, 2FF, 2FZ, 2KP, 2KU, 2KV, 2LH, 2NZ, 2OF, 2SQ, 2WT, 2ZK, 3AAG, 3AAO, (3AA), 3AFU, 3AJD, 3ALN, 3ANO, 3ANS, 3ANY, 3AOD, 3APD, 3AQF, 3AQH, 3AQR, 3ATZ, 3AVY, 3BA, 3BAG, 3BEC, 3BFG, 3BHL, 3BLF, 3BNU, 3BOF, 3BP, 3BUR, 3BZ, 3CA, 3CC, 3HG, 3HJ, 3IL, 3IZ, 3KM, 3LR, 3NH, 3QZ, 3RF, 3RP, 3RY, 3SM, (3SQ), 3VW, 3ZO, 3ZY, 3ZZ, 4BF, 4BQ, 4BY, (4DC), 4DQ, 4DZ, 4EH, 4EL, 4EH, 4GL, 4ID, 4JB, 4LP, 4YA, 4ZC, 5AAM, 5DA, 5FV, 5HO, 5LA, 5NZ, 6XA, 5ADG, 5ADP, 5AGO, 5AHZ, 5AIO, 5AIS, 5AIZ, 5AJV, 5ALD, 5ALV, 5AMQ, 5AOG, 5AOD, 5AQF, 5AQR, 5AQV, 5AQZ, 5ARD, 5AWM, 5AWP, 5AWY, 5AWZ (fone), 5AXC, 5BDB, 5BDU, 5BEX, 5BEF, 5BGF, 5BK, 5BLT, 5BNJ, 5BQ, 5BUN, 5BVK, 5BYD, 5BZC, 5BZF, 5BZY, 5CAB, 5CKO, 5CT, 5GE, 5HJ, 5HM, 5IQ, 5NV, 5OW, 5PC, 5PT, 5SE, 5SP, 5VJ, 5VY, 5WY, 5ZAE, 5AAP, 5AAS, 5AAV, 5AAY, 5AIV, 5AJH, 5ARK, 5ASL, 5AWM, 5AYH, 5BLO, 5BRL, 5BSG, 5CKD, 5DAX, 5DOF, 5DV, 5DYN, 5EI, 5FM, 5FZ, 5HW, 5IO, 5KP, 5LE, 5PF, 5UG, 5WA, 5ZL.

Spark—1AW, 1HO, 1RV, 2AER, 2AHU, 2BFX, 2BJO, 2EL, 2FP, 2OM, 2RM, 2WB, 3AJD, 3AOV, 3APT, 3BF, 3HJ, 3AN, 3KG, 3QZ, 3YV, 4AG, 4BI, 4BQ, 4CX, 4DQ, 4EA, 4GN, 4AFD, 4AHH, 4AIZ, 4ARD, 4AXY, (4AYM), 4AYN, 4BAZ, 4BRL, 4BSY, 4CH, 4SCHV, 4SCP, 4EB, 4EW, 4FT, 4OD, 4OI, 4RQ, (4TY), 4SY, 4AAW, 4ACB, 4AIR, 4ASJ, 4DCX, 4OX, 4UH, 4VL.

Leonard Strobel, Akron, Ohio

Spark—1AW, 2DN, 2FP, 2WB, 2WC, 3AJD, 3BCM, 3BM, 3NY, 3TA, 4AG, 4AK, 4AS, 4CX, 4EA, 4GN, 5BA, 5JD, 5AAS, 5ABA, 5ADQ, 5AFD, 5ALD, 5AOH, 5APD, 5ASY, 5AU, 5AUG, 5AWY, 5BAZ, 5BBV, 5BMP, 5BRL, 5CJ, 5CO, 5CP, 5EF, 5ER, 5EW, 5HY, 5IN, 5LB, 5LY, 5MG, 5MT, 5NO, 5RX, 5SP, 5TU, 5VA, 5VY, 5WL, 5XE, 5YN, 5ACB, 5ACM, 5AEG, 5AIR, 5AKM, 5ALA, 5ALO, 5AOU, 5AVL, 5AX, 5AZA, 5AZK, 5BIM, 5CP, 5DB, 5DEV, 5DHz, 5DIW, 5DKY, 5DQ, 5DRP, 5DSO, 5DUX, 5DYX, 5DZZ, 5GX, 5OX, 5VR, 5VW, 5WE, 5YA, 5ZB.

C.W.—1AJL, 1ALW, 1AOE, 1ASF, 1BAJ, 1BOL, 1BG, 1BGL, 1BKL, 1BKQ, 1CK, 1XAD fone, 1XM, 1YK, 1ZE, 2AAB, 2AWL, 2BB fone, 2BBB, 2BE, 2CA, 2CFT, 2CI, 2FP, 2HQ, 2OG, 2OP, 2SZ, 2UD, 2WT, 2WZ, 2ZK, 3AL, 3BD fone, 3BG, 3BHL, 3BVL, 3FW, 3GZ fone, 3AZ, 3ZY, 3ZZ, 4AAM, 4ADE, 4AX, 4BIY, 4BLF, 4BQ, 4BY, 4CM, 4CY, 4DF, 4DQ, 4EL, 4EU, 4FV, 4GL, 4GR, 4ID, 4XD, 4XQ, 4XY, 4XZ, 4YC, 4ZAB, 4ZC, 4ZZ, 5DA, 5DR, 5FV, 5GZ, 5MA, 5TU, 5ZL, 5ZW, 5ZZ, 5AB, 5ACF, 5AIM, 5AIV, 5AJ fone, 5ALV, 5AMU, 5ANX, 5AOG, 5APD, 5ARM, 5ARU, 5AW, 5AWY, 5AXK, 5BBK, 5BCM, 5BDO, 5BUM, 5BV, 5BYM fone, 5CP, 5DU, 5DV, 5OR, 5OW, 5QZ, 5RE, 5AZ, 5VY, 5WE, 5WR, 5XU, 5ZZ, 5AAP, 5AAU, 5AAV, 5ABA, 5ADB, 5AEZ, 5AKR, 5ALP, 5AMR, 5AMS, 5ARK, 5AW, 5AWB, 5AYU, 5BBF, 5BBD, 5BF, 5BP, 5BRL, 5BAX, 5DEW, 5DF, 5DJ, 5DP, 5DTA, 5DV, 5EI, 5FZ, 5IM, 5IO, 5KP fone, 5VL, 5VV, 5WK, 5WM, 5XW, 5YB, 5ZJ fone.

8AGO, Pittsburgh—All C.W.

(1II), 1QP, (1RD), 1XM, 1ZE, 1AZW, 1BUA, 1CAK, (1CMK), 2BG, 2FP, (2NZ), 2SQ, 2WI, 2WT, 2XQ, (2ZK), 2ZS, (2AAB), 2AJF, 2AMO, 2AQH, (2AYV), 2AWL, 2BAK, 2BEA, (2BEB), (2BEH), (2BFZ), 2BGT, 2BNC, (2BTJ), 2BYW, 2CCD, (3BA), 3BZ, 3CA, 3CC, 3CA, (3EM), (3FM), (3FS), 3GH, 3HG, 3HJ, (3IZ), 3JJ, 3KM, 3LR, (3QV), (3QZ), (3WW), 3XL, (3ZY), (3AAD), 3AAG, 3AAV, (3ADX), 3ANJ, (3ALN), 3APQ, (3AQH), (3AQR), 3ASO, 3ASW, (3BFS), (3BFU), 3BHL, (3BLF), 3BTK, 4AS, (4AZ), (4BF), 4BQ, 4BY, 4DQ, (4EU), 4FT, (4GL), 4IL, 4KC, 4LP, 4XD, (4ZC), (4ZE), 4YA, 5DA, 5EK, 5FV, 5HO, 5JB, 5NZ, 5PM, 5UU, 5WO, 5ZA, 5AAM, (6BO), 6ZZ, 6XAD, (8BK), (8BO), 8BU, (8GE), 8GW, 8HJ, (8IH), 8IQ, (8KH), 8PC, 8QB, (8SE), 8VJ, (8VY), (8UK) 8WY 8ZG, 8ZZ, 8AAN, (8ADG), 8ADM, 8AGZ, 8AIL, (8AIM), 8AIS, (8AMD), 8AMF, 8ANC, 8AQZ, (8ARI), 8ARK, 8ARW, 8AVD, 8AVO, (8AWM), (8AWP), 8AWY, 8AXK, 8BBD, 8BCA, 8BEL, 8BEY, 8BFX, 8BGV, 8BLT, 8BLW, 8BOX, (8BRM), 8BUN, 8UX, (8BXA), (8BZY), 8CJX, (8CLD), (9DV), 9EI, 9FM, 9FZ, 9HW, 9HY, 9IF, (9IL), (9IO), (9IZ), (9KI), (9KP), 9LE, 9AE, 9PS, 9PW, 9QE, 9SL, 9SO, (9UC), 9WA, 9WK, 9XL, 9ZE, 9ZG, 9ZL, 9AAS, (9AAV), 9AAV, 9AEQ, 9AJA, (9AJH), (9AKD), 9AMD, 9AMU, 9ANE, 9AOA, 9AQA, (9ARK), 9ARN, 9ASD, (9ATE), 9AYH, (9BED), 9BJB, 9BLC, 9BLO, (9BRL), 9DAM, (9DAX), 9DCF, 9DOF, 9DUN, (9DZQ), 9XAI, 9ZAE, Canadians (3BP), (3IZ), (3FO), 9AL.

8XE, State College, Pa.

(1ADL), (1AHL), 1APP, (1AW), 1AWB, 1AX, (1AZW), (1BKQ), 1BIR, (1BOF), 1BWJ, (1CZ), 1HO, 1MB, 1MX, (1RV), 1SN, (1XM), (1ZE), (2AGC), (2AJW), (2AQI), (2BB), 2BGM, 2BK, 2BJO, 2BPF, 2BML, (2BRC), (2BUM), 2CT, 2EA, (2EL), (2FP), 2OF, (2OM), 2PR, (2RM), 2VA, 2WB, (2ZL), (3ABB), 3AIE, 3AJD, 3AK, 3ARD, (3ARR), 3AUW, 3BAG, 3BHL, 3BJJ, 3BLF, 3BP, 3BZ, 3CN, 3EH, 3EL, (3FB), (3FM), 3HAY, 3HL, 3HQR, 3IP, 3MB, 3QF, (3QZ), (3TA), (3TJ), 3UD, 3UQ, 3XA, 3XW, 3ZAB, (3ZO), (4AS), 4DS, (4DZ), (4EA), (4EL), (4GL), (4GN), 4JB, 5AAB, (5FJ), (5FY), 5GL, 5NH, 5SM, 5XA, 5XB, 5YG, 5YH, 5ZAF, (5ACF), (5AIM), (5AIT), (5ARD), (5AUE), (5AUY), (5AXE), (5AYN), (5BEP), (5BEJ), (5BHV), (5BFS), (5CHO), (5DZ), (5IH), (5JJ), (5PI), (5QE), (5SP), (5UC), (5WM), (5AAP), 9AJ, 9AJA, (9AQV), (9ASJ), (9AXG), (9AZA), 9BRL, (9CP), 9DAX, (9DGX), (9DLX), 9DQ, 9DRR, (9DWP), 9DY, (9FS), 9IO, 9KT, 9OF, 9MC, 9OX, (9UH), 9VL, 9VZ, (9YC), (9YE), (9XE), 9ZL.

9ZJ, Indianapolis—Every District

Spark—2EH, 2OM, (3BP Can.), (3FO), 3KG, (3ZO), (3ZS), (4YA), 5EK, 5JD, 5KC, 5SM, 5QA, 5XA, (5XB), (5XI), (5XU), (5YE), (5ZAF), (5ZE), 5ZR), (5XQ), 7ZM, (8AGO), 8ARS, (8AXY), (8BRL), (8IN), (8LQ), 8MZ, 8OD, 8WO, 8XE, (8YAE), (8ZA), (8ZN), (8ZP), (8YU), 9ACB, 9AEY, 9AIG, 9AIR, 9AMS, 9AQQ, 9ASJ, (9AWU), (9AZE), (9BGP), (9BK), (9DXE), 9DZY, 9DMJ, 9GY, 9LF, 9OX, (9PB), 9RY, 9WU, 9WX, 9XAQ, (9XI), (9XM), (9YAE), (9YAJ), (9YAK), (9YB), (9YM), (9YQ), 9ZAF.

C.W.—1XM, 2BEA, 2BFX, 2BNZ, 2CCD, 2FP, 2FS, 2NZ, 3ALN, 3BG, 3BP Can., (3HJ), 3XW, (3ZO), (3ZY), 4CY, (4FT), 4GL, 5EK, 5ND, (5ZA), 6ZG, 6ZZ, 8AGO, 8AIO, 8ANJ, 8ARK, 8ARW, 8AVD, 8BBU, 8BCL, 8BDD, 8BK, 8BNJ, 8BO, 8XX, 8CJB, 8CQS, 8DV, 8QZ, 8UK, 8UY, 8VV, 8WO, 8XE, 8YD, 8ZZ, 9AAS, 9AJA, 9AKR, 9AMO, 9BRL, 9DOF, 9FD, 9IL, (9RV), (9XM), 9ZAF, 9ZG.

9APK, Chicago—Every District

Spark—(1ARY), 1XM, (2BJO), (2BK), (2FP), 2JZ, (2OM), 2PV, (2ARB), (3AJD), (3ALN), 3XM, (3ZA), 4CG, (4DH), 5AQ, (5BY), (5HK), (5JD), 5LO, 5IR, 5IF, 5PE, 5PG, 5QZ, 5QS, 5SM, 5FO, 5FV, (5NS), 5XA, 5XU, 5ZE, 6LC, (6XAG), (7KG), (7MP), (7ZV), 7ZU, 8ABO, (8AFA), 8AFD, (8AID), 8AIO, (8AIT), 8AOI, 8APP, (8ARD), 8ARS, (8AVO), (8AVT), (8AWU), 8AVH, 8AXY, 8AYE, (8BBU), (8BBY), (8BCO), 8BDV, (8BDY),

8BEF, (8BEN), 8BEP, 8BFM, (8BFX), 8BFY, 8CAY, 8CGY, (8CP), 8EA, (8EB), 8FA, (8FT), 8FZ, 8GA, (8JJ), 8KY, 8LB, 8RM, 8RQ, (8UC), 8WD, 8WO, 8BBX, (8BXC), (8BXX), 8YR, 8BQC, 8BOI, 8XE, 8YN, 8ZAA, 8ZAC, (8ZF), 9ABV, 9ACB, (9ACL), (9ACP), (9ADI), 9AEG, 9AEF, 9AIF, 9AIG, 9AIP, 9ALP, (9ALU), 9ANO, 9ANP, 9AOJ, (9APS), (9AQZ), (9ARG), 9ARZ, (9ASJ), (9ASK), (9AUA), 9AVK, 9AVZ, 9AYH, 9AYW, 9AZE, (9BCF), (9BIJ), 9BDJ, 9BMN, 9BRT, 9BSA, (9DEH), 9DBY, (9DGV), (9DHW), 9DGH, (9DHz), 9DKQ, (9DNC), (9DPB), 9DHH, 9DSW, 9DAG, 9FK, (9HR), 9JN, 9KA, (9MS), (9OA), (9OX), 9RY, (9UH), 9XT.

C.W.—1BKQ, 1COD, (2FP), 3ALN, 3ALR, 3AJD, 4CO, 4BQ, (6ZZ), 8AGO, (8AIO), 8AQV, 8AWM, 8AWP, 8AXK, 8BBK, (8BLW), 8IQ, 8BRL, 8BSS, 8BYR, 9AOG, 9BDV, (9DTA), 9ADI, 9QE, (9XI), 9ZAF, 9ZL, 8QB.

9BBE, LaSalle, Ill.

C.W.—1RU, 1XM, 1AFV, 1ARY, 1BCG, 1CAK, 2DN, 2EL, 2FD, 2FD, 2FP, 2FT, 2KP, 2UF, 2WF, 2WL, 2XB fone, 2ZL 2ZZ, 2AAX, 2AWL, 2BGM, 2BML, 2AM, 2DH, 2FB, 2FT, 2IW, 2LR, 2MO, 2QZ, 2XM, 2ZO, 2AAB, 2AEV, 2AHK, 2AQR, 2ARN, 2BLE, 2BA, 2BF, 2BK, 2BQ, 2CC, 2CO, 2CX, 2EL, 2FT 4GL, 2NX, 2SS, 2ZC, 2ZO, 2FV, 2HO, 2JD, 2LA, 2NK, 2NZ, 2RZ, 2SU, 2XB, 2ZZ, 2BK, 2CL, 2DX, 2GE, 2HM, 2HP, 2IL, 2IQ, 2JQ, 2LF, 2LU, (2LX), 2NQ, 2NX, 2OH, 2QQ, 2RQ, 2SP, 2UJ, 2VJ, 2VY, 2WR, 2XE, 2XK, 2XV, 2ZG, 2ZZ, 2ABV, 2AEG, 2AGZ, 2AIO, 2AIM, 2ALE, 2AOA, 2AOD, 2AQF, 2AQV, 2AWP, 2AWZ, 2BCI, 2BDU, 2BEF, 2BFX, 2BNE, 2BOW, 2BOX, 2BRC, 2BRK, 2BXA, 2ZAE, 2EL, (2HK), (2IF), 2IO, (2JL), 2KP, 2LQ, 2PI, 2PS, (2QE), 2RM, 2WA, 2WT, 2XD, 2YB, 2ZG, (2ZL), 9AAP, 9AAS, 9AAV, 9AAY, 9ABU, 9ACB, 9AJA, (9AJH), 9AKD, 9AKR, 9AMB, 9ANE, 9AQR, 9ARK, 9ASL, (9AYS), 9BAC, 9BAP, 9BBF, (9BEO), (9BFH), 9BIZ MB, (9BUH), (9DBV), (9DCR), 9DDY, (9DKH), 9DTA, 9DYE, (9DYN), 9DZW, 9XAC, 9XAM, 9YAM, Can. 3BP, 9AW.

Spark—1AW, 1DJ, 1SN, 1TS, 1AKG, 1AWZ, 2BK, 2EL, 2OM, 2RU, 2WB, 2WL, 2AJW, 3AC, 3AM, 3DH, 3DM, 3EL, 3HJ, 3IW, 3MS, 3UC, 3ZO, 3AQR, 4BE, 4BQ, 4CX, 4DH, 4FD, 4GN, 4JB, 5AA, 5AF, 5AI, 5BY, 5DA, 5DU, 5ED, 5EG, 5EK, 5ER, 5FW, 5FJ, 5FO, 5HK, 5IS, 5JD, 5MF, 5PY, 5QA, 5QS, 5SR, 5TD, 5TG, 5UU, 5XA, 5XB, 5XI, 5XJ, 5XM, 5XS, 5XU, 5YL, 5YL, 5ZA, 5ZL, 5ZS, 5ZW, 5ZN, 5ZZ, 5ZAB, 5ZAK, 5BP, 5CP, 5DW, 5EA, 5EB, 5ER, 5EW, 5FI, 5FK, 5FN, 5FT, 5GO, 5G, 5HG, 5HM, 5IN, 5JJ, 5KS, 5LH, 5LJ, 5MR, 5NZ, 5OI, 5PO, 5QA, 5QQ, 5RU, 5SP, 5TK, 5TT, 5UC, 5WI, 5XE, 5XS, 5YN, 5YT, 5ZD, 5ZN, 5ZP, 5ZR, 5ACP, 5ACN, 5ACR, 5AFB, 5AFD, 5AFP, 5AFK, 5AGK, 5AGO, 5AHH, 5AIB, 5AJX, 5AMD, 5AMZ, 5ANO, 5ARD, 5ARS, 5ATU, 5AWP, 5AYN, 5BBU, 5BEP, 5BNA, 5BRL, 5BUN, 5DBO, 5ZAA, 5AP, 5AU, 5BE, 5BF, 5BP, (5CA), 5CP, 5CS, 5EE, 5EL, 5ET, (5FK), 5FS, 5GC, 5GP, (5HK), 5HM, 5JN, 5JM, 5KO, (5KY), (5LF), 5LW, 5MC, 5ME, 5MF, 5MS, 5NQ, 5OX, 5PN, 5PS, 5RC, 5TL, 5UH, 5UI, 5VM, (5VW), 5XI, 5YA, 5YB, 5YC, 5YD, 5YO, 5ZJ, 5ZN, 5AAP, 5ABL, 5ACB, (5ACL), 5ACN, 5AEG, 5AEP, 5AEY, 5AFP, 5AFK, 5AGN, 5AGR, 5AHE, 5AIC, 5AIG, 5AIR, (5AJH), 5AJZ, 5AMA, (5AMR), 5AMS, 5AMT, 5ANO, 5AOU, (5APB), 5APK, 5APQ, 5AQE, 5ARZ, 5ASH, 5ATV, 5AUA, 5AUH, 5AWX, 5AYW, (5AZA), 5AZF, 5BBU, 5BCX, (5BDF), 5BHE, 5BHM, 5BHO, 5BIC, (5BIJ), (5BJA), 5BJT, 5BSA, (5BSC), (5BSI), 5BSO, (5BTA), (5BUO), (5BYF), 5BYM, 5DBU, 5DEH, 5DEU, (5DEV), (5DFX), (5DHD), (5DHz), 5DIG, 5DKV, 5DLX, 5DMP, 5DMW, 5DPQ, (5DQRI), 5DQQ, 5DRJ, (5DRN), 5DSO, 5DUG, 5DWP, 5DXL, 5DXM, 5DYU, 5DYV, 5DZQ, (5DZU), 5DZY, 5TTI, (QRA? PSE), 9YAK.

9AHC, Ellendale, N. D.

C.W.—1ARY, 1XM, 2FP, 4AZ, 4EH, 4XD, 4YA, 5DQ, 5EK, 5FV, 5HO, 5KP, 5LA, 5MT, 5OI, 5ZA, 5ZAC, 6KA, 6XAQ, 6ZZ, 7ZU, 8ABO, 8AGO, 8AJV, 8AM, 8APT, 8APV, 8AQF, 8AQV, 8ARD, 8ARW, 8AVO, 8AWM, 8BDU, 8BFX, 8BLW, 8BNJ, 8BO, 8BOX, 8BRL, 8BSS, 8BZC, 8BZY, 8CAZ, 8CFS, 8CJX, 8CX, 8HM, 8HZ, 8IQ, 8JL, 8LX, 8MP, 8OS,

8OW, 8OZ, 8QM, 8UK, 8VY, 9AAP, 9AAV, 9ACB, 9ADF, 9AEQ, 9AFB, 9AIF, 9AJA, 9AJH, 9AJP, 9AMB, 9AMU, 9ARK, 9ARZ, 9ASF, 9ASL, 9ATE, 9AWL, 9AWM, 9AXF, 9AYS, 9AZH, 9BAF, 9BBF, 9BED, 9BGH, 9BJB, 9BJL, 9BLO, 9BP, 9BRL, 9BSG, 9BTT, 9BUM, 9BCP, 9BYF, 9CAO, 9DCF, 9DCW, 9DGQ, 9DKY, 9DOF, 9DQM, 9DTH, 9DTM, 9DV, 9DVL, 9DX, 9DXN, 9DYI, 9DZQ, 9EW, 9FM, 9FZ, 9HT, 9IF, 9IL, 9JG, 9PC, 9PI, 9PS, 9QD, 9QE, 9SL, 9SO, 9VE, 9VK, 9WA, 9WK, 9XAQ, 9XI, 9YF, 9ZE, 9ZL, Canadian 3BP and 4CB.

Fone—9AG, 9AKX, 9ASF, 9BNO, 9PI, 9RZ, 9XAQ.

Spark—5EW, 5FO, 5HK, 5HZ, 5IF, 5LB, 5LO, 5NK, 5NS, 5PE, 5QL, 5SM, 5XB, 5XD, 5XU, 5YG, 7MP, 7XB, 7ZV, 8AY, 8AYN, 8BEP, 8BFH, 8LB, 9ABV, 9ACB, 9ACN, 9AEG, 9AEY, 9AFK, 9AFW, 9AGR, 9AHZ, 9AIG, 9AMI, 9ANF, 9ANP, 9ANQ, 9AOJ, 9AOU, 9APN, 9AQN, 9ASF, 9ASK, 9ASM, 9ASP, 9ATN, 9AUA, 9AUL, 9AVX, 9AVZ, 9AWZ, 9AXU, 9AYW, 9AZA, 9BGX, 9BHG, 9BMN, 9BOF, 9BRL, 9DEH, 9DEU, 9DJX, 9DKS, 9DPB, 9DSO, 9DUG, 9DUI, 9DXS, 9DXW, 9DZY, 9FX, 9GC, 9HI, 9IY, 9KI, 9LF, 9LW, 9MC, 9MS, 9OF, 9PI, 9RC, 9RY, 9SN, 9TI, 9UG, 9VL, 9WI, 9WY, 9XAI, 9XT, 9YAE, 9YAJ, 9YAK, 9YAL, 9YB, 9YQ, 9ZB, 9ZC, 9ZJ, Canadian 3GN.

Rev. 9AOR, Pequot, Minn.

C.W.—4FT, 5BQ, 5DD, 5EK, 5HO, 5KP, 6XO, 6XAD, 7HH, 7WE, 8AM, 8AWG, 8AXK, 8BCA, 8BEX, 8BFX, 8BGA, 8BH, 8BO, 8BOX, 8BSS, 8CFS, 8IL, 8LY, 8PN, 8RQ, 8UK, 8VY, 8WI, 8XAE, 8ZZ, 9AAI, 9AAP, 9AAU, 9AAV, (9ABB), 9ADF, 9AEG, 9AFB, 9AFX, 9AGN, 9AJA, 9AJH, (9AJP), 9AJS, 9AKD, 9AKK, 9AKR, 9ALH, 9AOU, 9AQQ, 9ASF, 9ATE, 9ATX, (9AUA), 9AUM, 9AVM, 9AWM, 9AWP, 9AXK, 9AYR, 9AYU, (9BAF), (9BAV), 9BBF, 9BDO, 9BDU, (9BED), (9BFG), 9BGH, 9BIO, 9BJL, 9BJV, 9BLW, 9BOW, 9BRL, 9BSG, 9BUM, 9DB, 9DCS, 9DFA, 9DFX, 9DG, 9DGE, 9DQG, 9DHA, 9DHC, 9DIG, 9DIM, 9DKY, 9DOF, 9DQM, 9DSG, 9DSW, 9DTH, 9DTM, 9DTS, 9DV, 9DXS, 9DYT, 9DZJ, 9DZQ, 9DZY, 9EI, 9EW, 9EX, 9FM, 9FW, 9FZ, 9HW, 9IL, 9IO, 9JL, 9KP, 9LJ, 9LL, 9LQ, 9NV, 9PI, 9PS, (9QE), 9SL, 9SW, 9UC, 9VK, 9VY, 9WQ, (9WU), 9WX, 9XI, 9XAQ, 9YAE, 9ZG, 9ZL.

Spark—5IS, 5JD, 9AAW, 9AEY, 9AIG, 9AIM, 9ANQ, 9ARZ, 9ARR, 9ASK, 9ATN, 9AUA, 9AVX, 9AVZ, 9AWZ, 9AXR, 9AYS, 9AZA, (9BAL), 9BIZ, 9BXC, 9DES, (9DGV), 9DIH, 9DKS, 9DNC, 9DSO, 9DZY, 9W, 9MF, 9XT, 9YB, 9YM, 9YAC, 9YAJ, (9YAK), 9ZC.

9DPX, St. Paul, Minnesota

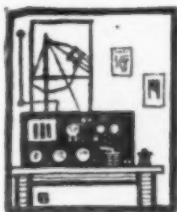
Spark—5AQ, 5EW, 5FO, 5HK, 5IF, 5JF, 5LB, 5NY, 5PU, 5SM, 5BBU, 5BXX, 5HG, 5HI, 5KI, 5LW, 5MC, 5MS, 5NQ, 5OA, 5OI, 5SN, 5VL, 5WI, 5WT, 5ABV, 5ACB, 5AEG, 5AFK, 5AGR, 5AHZ, 5AIF, 5AIG, 5AIK, 5ALO, 5AOJ, 5ASO, 5ATN, 5AUA, 5AVZ, 5AWZ, 5AXU, 5AYW, 5AZH, 5BRL, 5DCX, 5DEL, 5DFX, 5DJX, 5DKQ, 5DKS, 5DNC, 5DSO, 5DSU, 5DZL, 5DZJ, 5DZY.

C.W.—2XQ, 2BEA, 3BQ, 3AQR, 4BQ, 5EK, 5FV, 5HO, 5LA, 5NZ, 5OI, 5DV, 5GE, 5IO, 5MP, 5OS, 5OW, 5UK, 5WA, 5ARO, 5AIO, 5ALD, 5AMM, 5ANC, 5AOG, 5APT, 5AWM, 5AXK, 5BBX, 5BEO, 5BDU, 5BEF, 5BNJ, 5BUM, 5BXA, 5BZC, 5CFS, 5CGM, 5ZAE, 5EW, 5FZ, 5HW, 5HY, 5IO, 5KP, 5LQ, 5PS, 5QE, 5WA, 5ZE, 5ZG, 5ZL, 5AAP, 5AAV, 5AY, 5ARF, 5AIN, 5AJA, 5AKD, 5AOR, 5ARK, 5ATE, 5AWM, 5AYH, 5AYS, 5AZF, 5BAF, 5BBF, 5BED, 5BGH, 5BJB, 5BLO, 5BNO fone, 5BUM, 5DCR, 5DGL, 5DKY, 5DOF, 5DSM, 5DTS, 5DUN, 5DYN, 5DZQ, Canadian 3BP, 4CB.

9APW, St. Paul, Minnesota

C.W.—1ARY, 2FP, 3AQR, 3ZO, 3ZOV, 4BQ, 4FT, 4ZC, 4CY, 4BY, 5EK, 5ZA, 5LA, 5VR, 5UU, 5OI, 5ND, 6ZZ, 6XAD, 6ZF, 7HW, 8BE, 8DV, 8SP, 8VJ, 8VY, 8XV, 8ZZ, 8AGZ, 8AIM, 8AOG, 8APT, 8AQF, 8AWM, 8BDO, 8BLW, 8BFX, 8BUM, 8CAZ, 8CFS, 8CGM, 8ZAE, 9BY, 9DW, 9DK, 9FM, 9HW, 9KP, 9IO, 9JL, 9PI, 9RY, 9WU, 9ZY, 9ZX, 9ZR, 9ZL, 9VK, 9YQ, 9YF, 9AX, 9AAP, 9AAV, 9AAO, 9AAY, 9AOU, 9AAS, 9AJA, 9AJS, 9ATN, 9AVM,

(C. included on page 67)



Amateur Radio Stations



5HK, Oklahoma City, Okla.

The spark set 5HK of Le Roy Moffett, Jr., at 312½ North Broadway, has been heard in nearly all states. The picture shows a selection from over 600 cards and letters he has received since September.

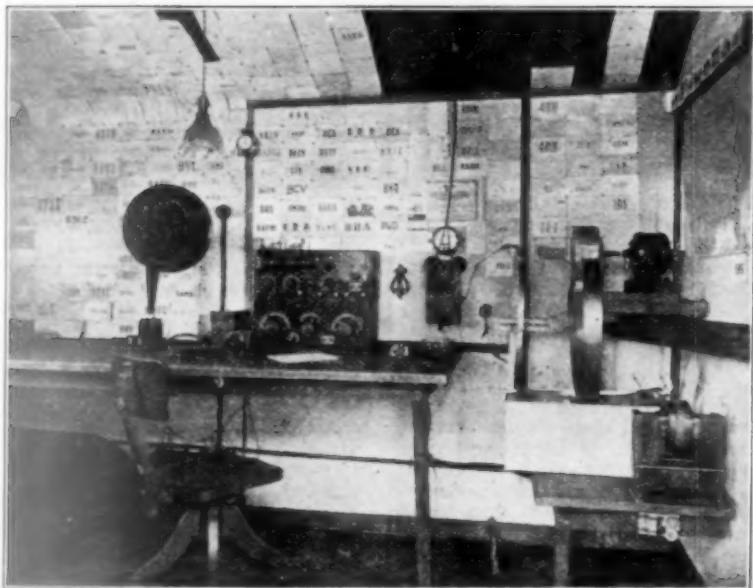
The antenna system is especially interesting. The aerial is a cage 12 feet in diameter, 93 feet high at the top, tapering to a bottom 3 feet in diameter with a 9-inch lead-in, the total length being 105 feet. A counterpoise is used, fanning out 80 degrees and covering all of the yard back of the shack and the yard to the left of the picture.

The transmitter has proven very efficient. The transformer is a 1 K.W. Acme. The condenser is a HE one and stands the gaff OK. It is an oil-immersed affair composed of 58 copper plates each separated by four 8-by-10 photo plates. The primary is a single turn of 2½ inch copper ribbon 22 inches in diameter and the secondary is made of 24 feet of ¼ inch strip. The gap is a Benwood eight-toothed driven by a variable speed motor, but as shown theoretically elsewhere in this issue the low tone is found to be best. We like this arrangement of the closed circuit, with the single-turn primary cut at the bottom for the condenser and at the top for the gap. Leads are minimized and the greatest efficiency secured thereby. With constant effort an antenna current of seven thermocouple amperes has been obtained.

The receiver is a Z-Nith regenerative with two steps of audio amplification, Baldy phones, Magnavox, W.E. and A.P. tubes.

5HK has been reported QSA from Boston, Mass., Seattle, Wash., Eugene, Oregon, Canada, and the Isle of Pines. He has worked 8RQ in Pennsylvania, 7ZU in Montana, and 6XAD in California. A 100 watt C.W. set will be going shortly to work





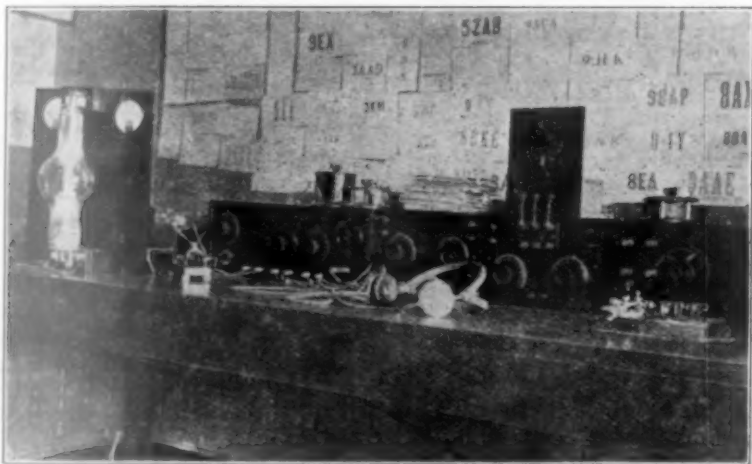
thru QRN. This station is strictly A.R. R.L. and has been handling on the average 100 messages per month and sometimes 200.

If school work didn't cause so much QRM he would probably QSR more.

9AAS, Owensboro, Ky.

9AAS, one of our leading C.W. stations, is almost entirely built by Robert W. Field, owner and operator, at Owensboro, Ky.

on the house, the flat top being 90 ft. long. The counterpoise is 12 ft. from the ground and has the same length and number of



The antenna is a nine wire inverted L supported 70 ft. high at one end by a persimmon tree and 60 ft. high by a pole

wires as the antenna.

The transmitter has just been changed from a 50 watt tube to a 250 watt U.V.204

with the result that cards have been coming in faster than it is possible to answer. The circuit used is similar to number nine in the Radio Corp's C.W. catalogue except that only one tube is used. Except for the tube, grid leak, and condensers, nearly all the set is home-made. The power transformer has the low voltage filament winding directly over the primary. The high voltage winding is on the other leg and delivers 2200 volts on each side of the mid-tap. The rectifier consists of 36 quart fruit jars although 26 seems best as it



gives better radiation due to lower resistance. The elements are of aluminum and lead, aluminum wire has been found satisfactory in every way for the aluminum electrodes, used with a saturated solution of borax. With $9\frac{1}{2}$ volts on the filament the antenna current is $3\frac{1}{2}$ amperes. Some trouble was experienced at first in getting the tube to run without overheating but it now runs fairly cool.

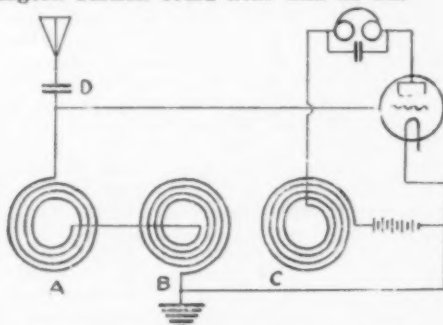
The receiver is regenerative with detector and two-step, all home-made. For plate voltage an 80 volt lead plate test tube battery is used.

9AAS has been reported in every district but the sixth, including Canada, and is an example of an excellent station where most

of it is home-made. The cost of such a station about equals the best one k.w. spark set and there is not a particle of doubt but that it is better.

A Two-Control Tuner

ONE of the entrants in the S.W. Smith Cup Contest described a novel spark wave tuner proposed by Mr. J. E. Parker, 3XK, which was used at 3AB1 in Washington with marked success. During the transcontinental relays the No. 1 west-bound message was followed until it reached the Sixth District, 5ZA being copied solid at a time when no other Washington station could hear him at all.



It is equally applicable to spark and C.W., and its performance is said to be greatly superior to all the usual varieties of single-circuit tuners. It is simplicity itself, A, B, and C being the three coils of a Turney "Spider-Web" Tuner, mounted on swinging doors. There are but two controls. A and B serve as a hinged variometer, B being the fixed coil and all tuning being done by swinging A. C is a tickler coil and regeneration and oscillation are controlled by swinging the door carrying it.

At 3AB1, on an average amateur aerial, when fixed condenser D had a capacity of 0.001 mfd. the wave length range of this set was from 150 to 240 meters.

Try it.

ALL OUT OF MARCH

The great demand occasioned by the publication of the improved Reinartz tuner in our March issue has completely exhausted our supply of that number. However, we have a limited supply of June, 1921, issue, in which complete information was given on the original tuner, hundreds of which are giving splendid performance in amateur stations. While they last, 20 cents the copy.

QST, 1045 Main St., Hartford, Conn.

Radio Communications by the Amateurs

The Publishers of QST assume no responsibility
for statements made herein by correspondents.



Telegraphy's the Thing

Dayton, Ohio.

Editor, QST—

Your editorial in March 1922 QST was read with much interest.

In dealing with the subject "Phones and Amateur Radio" it seems that an important point has not been brought out. What is the chief use of radio communication, anyway. I think it is the transmission of intelligence from point to point in the least possible time. Right here, we of the "TELEGRAPHERS" group, have a powerful argument. The long years of successful commercial traffic carried on by the Western Union and Postal Companies has proven the superiority of the telegraph over the telephone for the ACCURATE transmission of intelligence. The A.R.R.L. is altogether for the RAPID transmission of messages, and that is the fundamental usefulness of radio telegraphy.

The radio telephonists, both the listening classes and the transmitting classes even including the commercial broadcasting stations have no claim to actual utility, they only have popular support. They cannot argue that it is necessary, for instance, to transmit music from Pittsburgh to some distant point instantaneously. Even the lectures which are transmitted have no urgency demanding their transmission in a short space of time. I do not think the radio telephone has any logical claim to the ether, and I think our government should be made to see this point.

Let's use this powerful argument in furthering our interests: That radio communication has its greatest value in the rapid transmission of intelligence. The amateur relay men and commercial telegraphs should have preference over the phones.

Yours for RADIO TELEGRAPHY,

Paul R. Fenner,

Director, Dayton Radio School,
Former Editor Pacific Radio News.

Arc-Light QRM

Philadelphia, Pa.

Editor, QST—

I am a regular subscriber to QST. I have searched every month through it for some data on the elimination of arc light induction but so far I have been disap-

pointed. I will give you the conditions under which I labor and if you in your next issue will print something which will enlighten me on this subject I shall be under great obligations to you. I live about three doors from an elevated car line and under this elevated there is a string of arc lights on each side with a space of about thirty feet between each arc. My aerial, which is a four wire flat top, is parallel with this arc line. I was using a crystal detector when I first heard this noise and then changed to a regenerator and tube detector thinking I could eliminate this noise. Instead it came in louder and at a friend's suggestion I shunted a variable condenser from the ground to the B Battery. This also did no good. I then erected an aerial at right angles to the arc line but this also was useless. I now started to get at my ground. I had been using buried chicken wire for a ground and I tried the radiator and then a tin roof but it did not make the slightest difference. I am at the end of my resources and look to you for help.

Thanking you in advance, I remain
A Very Disheartened Ham.

(We regret to say that we do not know an effective way of getting around this trouble—and it has kept many a good station quiet for a season at a time. Does anybody know any way around it? If so, please let us have the dope at once, for publication. Some hope is held in the balancing-out scheme, whereby a second aerial or perhaps preferably a loop would pick up additional arc-QRM and couple it into the tuner in the reverse direction from the regular aerial, thereby cancelling out the QRM and leaving the signals collected on the main aerial. Anybody tried this with success? Help!—Ed.)

Rotten Routing

90 Mountain Ave.,
Summit, N. J.

Editor, QST—

In reading a letter of Staff Sgt. Walkeen, published in January QST, I noticed that he says one should QSR a msg. to keep it going. That is very good as far as it goes but it seems to me that too many amateurs

QSR just to keep the msg. going and not to get it to its destination. The lack of judgment shown in relaying some msgs. is appalling. I have QSR'd east and heard the msg. come back from the south a week later to another station in the same town. It might better to delay a msg. a short time rather than QSR in the wrong direction just to get rid of it. Many a msg. never gets to its destination because it goes around in circles until someone gets wise to the fact that the information in it is too old to be any good and therefore throws it in the waste paper basket.

Most of this trouble could be remedied by a little thought and possibly the use of a map.

73, CUL.

Leonard Richards, 2AFR.

Keep Your Eyes Open

Lebanon, Ind.

Editor, QST—

List to my sad tale. Honest,—I've got a real kick coming this time. It isn't often that I get peeved enough to want to break into print, except of course, when something begins to interfere with the great old game, radio.

Now I honestly believe that the radio manufacturers are going to queer this kitty of ours unless we rise up wrath and get the wouff houn'g to working. The case in point is this—No long since a prominent radio man, sales manager of an eastern manufacturing concern of long standing, came to Indianapolis and indulged in a speech the substance of which may be summed up as follows—The people who are putting in expensive radio sets to receive wireless music do not want to hear this dah-de-dah stuff—they are not going to take the time to learn the code—and, if interfered with, are going to raise considerable protest.—Thus, unless the amateur lays off between the hours of 6 and 11 P.M., he will simply be legislated out of existence.

For the past ten years his firm, and all the rest of 'em, depended upon me and the hundred thousand other dah-de-dah amateurs to keep them going. The amateur made possible the development of the apparatus we have today, and some of our best designers come from that same gang. But, now that the manufacturers have a new and extremely gullible field for their operations, we are going to be "legislated out of existence very promptly".

Laying aside the fact that, this attitude makes us peevish, let's see if there isn't a solution to the problem:—

The amateur has a definite place in this scheme of affairs. Wouldn't the Signal Corps be in a heluvafix with this Radiola gang for ops? And everybody enjoys the concerts, for some really worth-while music is being sent out. I don't mean this Vic-

trola stuff that we have to stand for most of the time, though.

Thus why can't the manufacturers build a set for the amateur that works from 100 to 300 meters, and another for the Radiola outfit that responds to the band of wave lengths between 600 and 1,000. The unused section between 600 and 1,000 meters would be very satisfactory for radio music, and any amateur can get it after about three minutes work connecting a honey-comb coil. There is plenty of room for both of us, so let's stop this impending fight right now before it is too late. Otherwise it will mean the scrapping of a lot of apparatus.

Whenever an amateur game of any kind is commercialized, it is promptly relegated to the scrap heap. So let's get busy and start something.

Sincerely,

Bayard Shumate, 9KR.

Welcome Brother

326-18th St.,
Toledo, O.

Dear QST:—

I am a new reader or your magazine and get a devluvolot of amusement out of it. But I want to tell you how I feel about all this.

I first became interested in radio through radio music (?) and having been a professional musician for the past eighteen years I naturally became interested in the possibility of home folks enjoying good music at home. I purchased a number of radio magazines among which was QST and it goes without saying that I soon felt my lack of enlightenment on radio most keenly. Asking for some information at a local supply concern I was advised to cultivate the acquaintance of someone who knew and little by little I would pick it up! That is like that famous bit of advice: "Send your boy to college and the boys will educate him."

I bought books on the subject only to find that they were so mathematical that I could get little out of it, it having been some 20 years since I looked a quadratic in the face.

I had just begun to feel this was a cold, cold world and that you just had to know before you could understand what anyone was trying to tell you about radio and O joy, QST comes out with "Getting Started Listening" in the March issue. I read and understood every word of it. No, I know that it is not explanatory of the principles of wireless which I so much crave but it is something. Just give me time and I will get the principles. Just give me time and I will come to the point in this letter.

I started this thing interested in fone only, and was willing to listen to most anything so long as it came over the ether. But driv'el is driv'el and doubly so when it comes over the radiophone. Occasionally

some worth-while stuff comes over the wireless fone but 90% of it is worse than garbage from a musical festival. Being a musician, I detest jazz. When a person learns to appreciate—that is, listen to—music he no longer cares for jazz. Some folks prefer bologna to sirloin; folks with the same comparative musical tastes demand jazz, and get it, worse yet, by way of radio.

So I have lost interest in fones and want to learn all I can about telegraph receiving and transmission. Dear QST, couldn't you find space for a little information each month for us who want to know about radio and—there are thousands of us. Slip the mathematics to us gradually and we will assimilate in small doses.

Very truly yours,
Ben F. Boyer.

Back to Earth

Norfolk, Va.

Editor, QST—

In reading over the January number of your valued paper, "QST", I note the following under "Strays":—

"Recent news service pictures show a cow-person on horse-back with a portable radio set, overhead antenna, etc., all prepared to round up stray cattle. The thing that bothers us is what do they do for a ground—have a binding post in the horse's side?"

I imagine you have had many restless nights, pondering over this deep problem, and thinking that perhaps you might be relieved by any solution, good, bad or indifferent, may I suggest that the ground lead be attached to the horse's (g)irth? It is only a simple problem in mathematics to subtract the "g".

Being an ex-Signal Corps man, I once had the pleasure (?) of "spilling over" one of the brutes referred to, and while I found the transmitter was very efficient a highly-damped ground offered poor reception. I am for hooking the antenna to the bridle and the ground lead as suggested above.

With kind regards, I am,
Yours truly,
R. I.

A Spark Coil C.W. Set

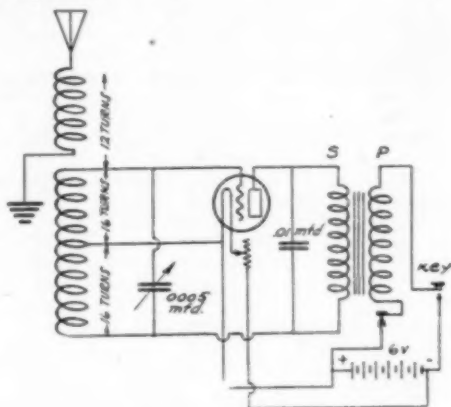
2065 Belmont Ave.,
Bronx, N. Y.

Editor, QST—

QST readers may be interested in my spark coil C.W. set. A diagram is here given.

I have found by experiment that inductive coupling will give better results than conductive coupling on a set of this type. By putting a 2 volt flash light bulb in the antenna circuit, the set can easily be adjusted to resonance. The apparatus needed is a Quaker Oats tube or any other 4 inch tube, a roll of insulated annunciator wire, a .0005 mfd. variable condenser (a

small Murdock is just right), a U.V.201 amplifier tube or any other hard tube operating off 6 volts, a rheostat, a $\frac{1}{2}$ or 1 inch spark coil, a .01 mfd. fixed mica condenser to lower secondary voltage and pass high frequency.



Twelve turns are wound at the top of the tube for the antenna inductance. A space of 2 inches is left and the grid-plate coil is wound. This consists of 32 turns with a tap at the center. The only tuning element is the variable condenser. If the set does not oscillate then reverse the connections to the primary of the spark coil. A toy step-down transformer can be used to light the filament.

With this set I have no trouble working 55 miles daylight. This set can be used to radio-phone 1 mile if a microphone is placed in primary of spark coil and the vibrator tightened.

Samuel Kopelson,
2BCF.

Rotten Msg.-Delivery

2111 So. Franklin St.,
Denver, Colo.

Editor, QST—

Being a very enthusiastic amateur and working for the success of amateur radio, I am taking the privilege of expressing my idea of the present day conditions of amateur relay stations.

First of all I wish to say that I, myself, have sent many relay messages to different points, mostly east of Denver, to localities that have many large relay stations, but I am sorry to say that not a one out of at least twenty messages has ever reached its final destination. Why? Why should a station accept a message if he does not intend to or cannot, deliver it?

I will name the destinations of a few recent messages sent from here (Denver) so you may see just why I have a good base for my argument. First we have Chicago, Ill. When you ask a relay man if he can

QSR Chicago, why he will always say "Sure, that will be easy", yet I have never succeeded in getting a message delivered there, even after hearing the message given to a Chicago relay station. Then comes La Crosse, Wis. This is a large radio center, yet I have never succeeded in getting a message there. Then we have Aurora, Ill., about thirty or forty miles from Chicago; Rockford, Ill. approximately eighty-two miles from Chicago, and again we have no success in getting messages to any of these points. Again, I ask, what is the trouble? It isn't the radio relay league proper, it's the stations representing them improperly.

Mr. Editor, if you look at this subject as serious as I do, I am sure you will give it a little thought. I would appreciate it very much if you would consider publishing this problem in an early edition of the QST as I would like to hear some one else's opinion on this difficulty.

R. C. Schryver, 9AWL.

CALLS HEARD

(Concluded from Page 60)

9AYS, 9AWM, 9QE, 9AOG, 9AFB, 9AZH, 9BJB, 9BOG, 9BVY, 9BRG, 9BRS, 9BSG, 9BLO, 9BAF, 9BFX, 9DHE, 9DDW, 9DSW, 9DJI, 9DYN, 9DVA, 9DZQ, 9DTH, 9ZG, 9ARK, 9ASF, 9DTS, 9DBG, Canadian 4CB, 3BP.
Spark—Canadian 3JL, 3FO, 3EL, 3GN, 3BP.
U.S.—4BQ, 3XM, 5SM, 5DD, 5XB, 5XU, 5FO, 5HK, 5XA, 8YU, 8JJ, 8CP, 8YN, 8BEP, 8BEF, 8ZP, 9APA, 9HL, 9HT, 9HR, 9KL, 9IY, 9OF,

9JQ, 9MS, 9MC, 9LW, 9OA, 9WT, 9WI, 9TI, 9ZX, 9XM, 9ZO, 9RC, 9AAP, 9AIF, 9AIG, 9AZA, 9AVZ, 9AYW, 9ANF, 9AMQ, 9AEG, 9AFK, 9AVP, 9DEH, 9DMC, 9DMK, 9DUG, 9DSD, 9DSM, 9DSO, 9DIW, 9BKW, 9DFA, 9DZY, 9DZI, 9DZE, 9YAJ, 9YAE, 9YAK, 9YAC.

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Automatic Screw	Punch Press Work
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Machine Products	Product of any Nature
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Japanning	Cabinet Work.
Plastic Material	
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Electric Motor	
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PLEASE REFER TO BOX "C,"
QST, HARTFORD, CONN.

WANTED: A Publicity Manager

The A.R.R.L. desires to engage the services of a qualified publicity manager. In addition to knowing the ropes of his profession and being able to write, he must be a radio amateur of known attainments and fully acquainted with the A.R.R.L. spirit, its traditions and the amateur viewpoint. Give full qualifications in first letter, stating salary desired, etc., addressing the Secretary.

American Radio Relay League,

Hartford, Conn.

Of Interest to Display and Classified Advertisers

We are pleased to announce that this issue of QST is running 50,000 copies. The recognized merit of QST as the best magazine for the progressive radio amateur and experimenter—its nation-wide prestige as the publication of the American Radio Relay League, THE national association of amateurs, has resulted in an enormous yet healthy demand, and consequently greatly increased circulation. For the last number of months QST has grown by thousands with each issue, and this growth continues unabated. Of interest to the up-to-date advertiser is the fact that paid-in-advance circulation is growing in proper proportion to counter sales.

QST's unquestioned value to the progressive manufacturer and dealer is therefore immeasurably greater. The axiom that apparatus of merit can be most profitably advertised in QST is truer than ever.

Classified advertising is six cents a word in advance, as explained at the head of that department in this issue. Display advertising rates will be promptly mailed any reputable manufacturer or dealer. Please address:

Advertising Manager, QST, Kennedy Building, Hartford, Conn.

Another

TELMACO

Achievement

The TELMACOPHONE

Here Is the Height of Telmaco Perfection

Equipped with Baldwin Type C Unit, Inverted horn, reflected tone. Equal to any other horn twice its length. Designed and perfected by expert acousticians. Complete in every detail.

Don't be misled into buying a loud speaker offered for less, and expect satisfaction; for a loud speaker of quality cannot be sold for less. Only after the most exhaustive tests and comparisons with the other loud speakers; and only after the most thorough research, laboratory tests and field demonstrations has the **Telmaco-phone** been perfected, and offered now, for the first time to the public.

Telmaco Amplifiers, Receivers, Detectors, Variometers, and Variocouplers have earned a national reputation for quality, endurance and satisfaction not excelled by any other line. You can expect equal satisfaction from the Telmacophone.

We advise the purchase of the Telmacophone without unit for those who have Baldwin Unit of their own.

Dealers! We are distributors for nearly all standard lines. Full discounts on the Telmacophone. Write for proposition on our complete line.

RADIO DIVISION

Telephone Maintenance Co.

NOTE NEW ADDRESS

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Chicago, Ill.



*No extras to buy.
Nothing to get out
of order.*

Price
Complete \$20.00

Fully
Guaranteed

Price without Baldwin Unit,
but with cap attached, \$14.50

WETMORE-SAVAGE COMPANY

BOSTON, MASS.

Jobbers of

**ELECTRICAL
SUPPLIES**

**AUTOMOTIVE EQUIPMENT
SUPPLIES**

Have Recently Entered the Field of

RADIO APPARATUS AND SUPPLIES

We will do a **WHOLESALE BUSINESS** only and solicit correspondence with reliable manufacturers who are desirous of receiving the best representation for the New England States.

Reduce those QRN Atmospherics NOW with Burgess "B" Batteries

NOISELESS! That describes Burgess "B" Batteries. **Absolutely** noiseless! Weak and distant audio frequency signals can be received with multi-stage amplifiers and Burgess "B" Batteries because Burgess "B" Batteries **do not drown out signals.**

BURGESS "B" Batteries assure clear receiving. They will increase the efficiency of any receiving set. They are cheapest in hours of service. And they are sold by all reliable dealers in radio equipment. Look for the black and white stripes. If you can't get Burgess "B" from your dealer, just drop a line to us, care Dept. D.

BURGESS BATTERY COMPANY

General Sales Office
Harris Trust Bldg.,
Chicago

Offices and
Distributing Warehouses
Chicago, Ill.,
111 W. Monroe St.
Madison, Wis.,
Main & Beverly Sts.
Kansas City, Mo.,
2109 Grand Ave.
St. Paul, Minn.,
2362 University Av.
Boston, Mass.,
136 Federal St.
New York,
50 Church St.
Winnipeg, Man.,
701 Wellington Av.

As indicated in the illustration, Burgess Batteries are supplied with both flexible wire terminals and binding post terminals. The binding post terminals are complete with hexagon nuts and brass nuts, making it possible to attach wires directly to the cells without the use of solder or bolts.



ALWAYS MENTION QST WHEN WRITING TO ADVERTISERS

Price \$12.00 F.O.B. N.Y. City



NOTICE: All infringers of this device will be vigorously prosecuted.

Listen to the Concerts, News and Dance with a KING "AM-PLI-TONE."

Just slip your head phones on the "AM-PLI-TONE" and you and your friends will be SURPRISED.

Polished Cast Aluminum Body with Nickle Plated Base and Horn. No sheet Metal is used, the "Tiny" Sound is Left Out. The VOLUME is DOUBLED because TWO head phones are blended into one POWERFUL tone.

A big hit—a big seller and immediate deliveries. Dealers and distributors what more can you ask? Write today for territory--KING "AM-PLI-TONE"

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IMMEDIATE DELIVERY

On DeForest Radiophone Sets at \$36.00
and 2-Step Amplifiers at \$35.00

We are Jobbers for Grebe, DeForest, Clapp-Eastham, John Firth, Mignon, Hipco B. Batteries and Eveready Batteries.

WE CARRY VALLEY CHARGERS

HICKSON ELECTRIC COMPANY, Inc.

36 SOUTH AVE.,

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MURDOCK

radio necessities



No. 56 Phones

MURDOCK REAL RADIO RECEIVERS have delivered complete satisfaction, on a "money-back" basis for 14 years. Those years of experience have so simplified and perfected our production that there are today no receivers quite so good at so low a price.

The latest Murdock achievement, the No. 56 Receiver, is a highly sensitive instrument which retains all the rugged strength of previous types. Important features are, the improved comfortable headband, the "Murdock-Moulded" ear pieces shaped to exclude outside noises and the moulding of all parts into one durable unit.

All models of Murdock receivers are sold with free trial offer and money-back guarantee. Use them in direct comparison to any other phones for 14 days.

Make any test you wish. Then at the end of the two weeks, if the Murdock Phones are not entirely satisfactory, return them and your money will be refunded!

We strongly urge you to go to your dealer, and convince yourself of the quality of Murdock receivers, by actual examination, before you buy. Prices \$5.00 to \$6.00.

Murdock Phones are the standard bearer for a complete line of "Made-by-Murdock" radio parts and instruments. This includes the famous Murdock condensers, sockets and detectors, and the new Murdock Rheostat.

Buy Murdock apparatus from your dealer.

WM. J. MURDOCK Co.

CW Transmitter and Receiver Parts



TYPE 156 SOCKET

The experimenter who has had previous experience with the assembly of receiving and transmitter sets has learned the necessity of having every unit perfect. Entirely aside from the gain in efficiency, he has found the advantage of using apparatus in which the greatest care has been given to construction details.

General Radio apparatus is designed with this end in view. A noteworthy example is the Type 156 Vacuum Tube Socket.

This socket is adapted to any of the standard American four-prong transmitting or receiving tubes. It is adapted to the Western Electric VT-2 tube, as well as to the Radiotron UV-200, 201 or 202 tubes. The contact springs are sufficiently rugged to carry the filament current of the five-watt transmitting tubes without arcing.

Price \$1.50

This is but one example. Others are Amplifying Transformers, Modulation Transformers, Tuning Inductances, Hot Wire Meters, etc. SEND FOR FREE BULLETIN 911Q describing these and other instruments.

GENERAL RADIO COMPANY

Massachusetts Avenue and Windsor Street

CAMBRIDGE 39,

MASSACHUSETTS

Standardize on General Radio Equipment Throughout

CARRIED BY LEADING DEALERS

D. H. E. Co.—Pittsburgh Broadcasting Station—Call, K.Q.V.

"Listen In" with the Stromberg - Carlson Headset



Stromberg-Carlson
No. 2-A Headset

\$7.50

The Stromberg-Carlson No. 2-A Headset reproduces broadcasted, long-distance vocal or musical sounds with unequalled distinctness. Fine tonal qualities, extreme sensitiveness and superior construction are its important features.

Order Above and Following Highest Grade Supplies By Mail

Enclose Certified Check or P. O. Money Order including Postage.

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RORK Grebe 2 Stage Amplifier	55.00
R2 Magnavox Loud Speaker	110.00
R3 Magnavox Loud Speaker	45.00
UV200 Radiotron Detector Tubes	Each, 5.00
UV201 Radiotron Detector Tubes	Each, 6.50
#766 Eveready VT Batteries	Each, 3.00
D.H.E. 6 volt, 80 ampere storage batteries	Each, 18.00

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Latest method of putting your messages in Cipher. Simple. Our booklet "Cipher Codes" and complete instructions \$1.00. Send your Order Today.

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Our price list, mailed Free on request. Contains complete lists of reliable Radio Sets and parts—every article carrying our guarantee.

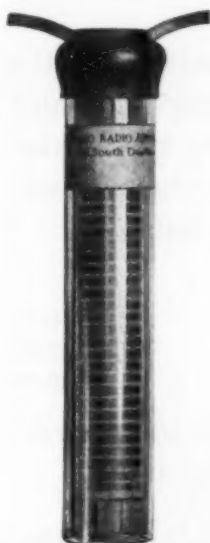
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48 FULTON ST.,

NEW YORK CITY

"Chi-Rad" Apparatus



New Storage "B" Battery

A real storage "B" Battery for your Radio Set at a price every Amateur and Experimenter can afford to pay. Can be used on receiving apparatus as source of plate potential on both Detector and Amplifier tubes. Ideal as source of energy on small Radio Telephones or C.W. Transmitters.

Simple and easy to re-charge from your lamp socket and will last for years with ordinary use.

Price per cell \$0.50
Add PP on $\frac{1}{4}$ lb.
per cell.

SPECIFICATIONS:

Cut shows cell one half natural size.

Voltage per cell 2 volts.

Pasted Plates—ready formed for initial charge.

High Ampere Hour capacity—will operate one detector tube 1000 hours with one charge.

Shipped dry with simple directions for preparing the electrolyte.

Mahogany Tray for holding ten cells \$1.00 extra

Dealers:—Get our discounts on this new Battery—your customers will want them!

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About April 1st we will move to 415 South Dearborn Street where we will open a High-Grade Ground Floor Salesroom. With greatly increased space we will carry every make of good Radio Apparatus and will endeavor to have

"The Finest Radio Retail Salesroom in Chicago."

CHICAGO RADIO APPARATUS CO., Inc.

415 South Dearborn Street,

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Hartford Radio Battery

Our radio "A" batteries are up to the Hartford Standard of excellence which means that no battery of any type leaves our plant until it has successfully surmounted a series of careful tests.

Type 5R	30 to 40 Ampere Hour	\$10.00
Type 7R	45 to 60 Ampere Hour	12.00
Type 9R	60 to 80 Ampere Hour	15.00

If there is not a Hartford dealer in your vicinity we will forward a battery direct to you upon receipt of draft or money order.

The Hartford Battery Mfg. Co. Milldale, Conn.

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Protect your homes against damage from Lightning. Your insurance is void without proper ground protection

OUR WIRELESS GROUND SWITCH 3333

Complies
With
Underwriters'
Requirements.



Mounted on
Ebony
Asbestos
Base, with
5 inch brake
600V SP DT.

Catalogue No. 3333 List \$3.50

Barber Electric Manufacturing Company
North Attleboro, Mass.

If your dealer cannot supply you, your mail order will receive prompt attention.

**Best of Everything in
Radio Apparatus and Parts**

Send Stamp for Catalog "Q"

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ASK

Boston, Savannah, Philadelphia, New Orleans, Baltimore,
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SHIP OWNERS
RADIO SERVICE INC.

Send 6 cents in stamps for our latest booklet

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A-P

—the tubes which heard
across the ATLANTIC
—the tubes that are
used by those who KNOW

—this A-P COMBINATION



The A-P VT
AMPLIFIER
OSCILLATOR

—the Amplifier used by
the U. S. Navy. "Use
the tube the Navy
uses." Price—\$6.50.

The A-P VT AMPLIFIER
OSCILLATOR and the A-P
ELECTRON RELAY, with
the SHAW standard 4-prong
base, are the perfect vacuum
tube combination, the origi-
nal vacuum tube combina-
tion. Ask your dealer for
these A-P tubes by name. If
he does not have them, order
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A-P tubes are licensed by the
Radio Corporation of America
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experimental use in radio com-
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The A-P
ELECTRON
RELAY

—the most sensitive de-
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known to the radio art.
Price—\$5.

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---it's in Dallas

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C'mon 5th. District, buy from the hub of the Southwest, the City that has made Radio famous in this neck of the woods, and from the Company that has had the major portion in developing Radio interest in Mr. Citizen. Our long experience enables us to handle your orders and inquiries with celerity—give us a trial!

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A SUPER-AMPLIFIER for WIRELESS TELEPHONE and TELEGRAPH SIGNALS

DX AMPLIFIER

Type DX-2, Detector and Two step, with special amplifying transformers, completely wired, only,

\$48.00

IMMEDIATE DELIVERY

Satisfaction Absolutely Guaranteed
Descriptive Folder sent upon request
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Summit, Illinois,

"Where Dependable Quality Is Low Priced"

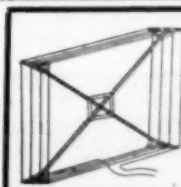
Factory, Argo

One Hand Will Do Clip-Grip Screw Driver for Wireless



Holds the screw firmly while inserting or removing.
Special wireless set of 2 sizes. Send 50c.
THE NOVA CO., Bonheur Bldg., 326 River St., Chicago

76



RECEIVE ON AN INDOOR COIL AERIAL

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- 1915 First regenerative receiver ever manufactured bore the name PARAGON.
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The Adams-Morgan Company

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UPPER MONTCLAIR, N. J.



\$12.00

without receivers
Add 25c for post-
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West of Rocky
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There is a difference between the Rhamstine* Adapt-O-Phone and the ordinary loud-speaking devices. It is a difference developed by the Rhamstine* Shops following the exclusive Rhamstine* Design.

Your own matched receivers are used, the sounds being clearly and correctly amplified in the Adapt-O-Phone; it is attractively finished and stands 20 inches high.

Send for complete circulars showing other Rhamstine* Products—Plugs and Jacks, Amplifying Transformers, VT Sockets, VT Batteries, etc.

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J. THOS. RHAMSTINE*

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*Maker of Radio Products

Try REYNOLDS RADIO Service from DENVER

(Old)
"9ZAF"

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Federal Jr. Receiving Set	\$25.00
214 Stranded Aerial Wire 100 ft.	\$1.00
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"Experimental Wireless Stations," Edelman	\$3.00
"Wireless Telegraphy & Telephony," A. P. Morgan	1.50
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MAGNET WIRE			
Spool	Size	SCC	SSC
4 oz.	20	.45	.50
4 oz.	22	.50	.55
4 oz.	24	.50	.45
4 oz.	26	.55	.70
8 oz.	20	.65	.80
8 oz.	22	.75	.90
8 oz.	24	.80	1.00
8 oz.	26	.85	1.15
12 oz.	20	.90	1.10
12 oz.	22	1.00	1.25
12 oz.	24	1.10	1.40
12 oz.	26	1.25	1.65

Complete line Jewell Meters.
Include postage with all orders.

REYNOLDS RADIO CO. Inc. Distributors **DENVER, Colo.**
613 19th Street

G-A STANDARDIZED RADIO SUPPLIES

FOR THE MAN WHO MAKES HIS OWN
Send 10c for the new G-A. catalog

The General Apparatus Co., Inc.

88-T PARK PLACE

NEW YORK

WIRELESS TELEPHONE AND RADIO APPARATUS (Complete Sets)

CLARK & MILLS ELECTRIC COMPANY
ELECTRAGISTS

75 Newbury St., BOSTON

Tels. Back Bay 385 & 386 & 8296

1444 Massachusetts Ave., CAMBRIDGE

Tel. University 1100

"The right path is near,
"yet men seek it afar off,"
says Mencius.
The right Receiver is here—
the Grebe CR-5—
The wise Radioist
need seek no further!

Doctor Wu

Chelsea No. 50 Amplifying Transformer



Was designed for use with the present day models of vacuum tubes, and when so used produces remarkable amplification, with minimum noise. It is well adapted for table mounting or may be panel mounted in any position. Its high efficiency together with its neat appearance and compactness, makes it a predominating feature in any radio receiving equipment.

Price as shown\$4.50
Unmounted3.75

Bulletins sent upon request

Purchase from your dealer. If he does not have it, send to us.

CHELSEA RADIO COMPANY

159 FIFTH STREET,

CHELSEA, MASS.



BRACH VACUUM ARRESTERS

Are Not Alone the Highest Type of Lightning Protection But Take Off Most of the Static Recommended and Used By Radio Clubs, Manufacturers, Radio Engineers and U. S. Army.

Approved, Listed and Recommended by the National Board of Fire Underwriters.

GIVE AUTOMATIC PROTECTION



Carried in Stock by All Dealers and Distributed by Leading Electrical and Radio Jobbers.

L. S. BRACH MFG. CO.

Manufacturers of Lightning Arresters for 16 Years
NEWARK, N. J.

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On and after May 1st. 1922

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Radio Electric Co.

will be located at its

New Five Story Building

1427-29 LIBERTY AVENUE

PITTSBURGH, PA.

Manufacturing and Wholesale Business will be carried on Exclusively at this location, attended by the same Expert Radio Service you have enjoyed in the past.

ALL RETAIL SALES

will be handled at

The Radio Electric Co.

3807 Fifth Ave., Pittsburgh, Pa.

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New York, N. Y.
9 South Clinton Street,
Chicago, Ill.
414 Finance Building,
Cleveland, Ohio
1042 Granite Building,
Rochester, N. Y.
422 First Avenue,
Pittsburgh, Pa.



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Sheldon Building,
San Francisco, Cal.
932 Real Estate Trust Bldg.,
Philadelphia, Pa.
321 Title Building,
Baltimore, Md.
415 Ohio Building,
Toledo, Ohio

For the Capable Radio Technician

THE man who really knows radio—who can build his own instruments and keep them in condition—is always a friend of Formica insulation.

He knows what insulation troubles mean, and he knows that cheap absorbent materials full of weak spots are sure to worry him sooner or later.

Formica is approved by the Navy and the Signal Corps. It is weather-proof, warp-proof and maintains its good looks and high dielectric strength under all conditions. It is a solid insulating material of the highest efficiency all the way thru.

Formica works easily with ordinary tools and does not chip or crack. You can get panels cut to size from most radio dealers and the only tool needed to complete the panel is a drill.

Write now for descriptive folder on Formica

The Formica Insulation Company
4620 Spring Grove Avenue,
Cincinnati, O.,

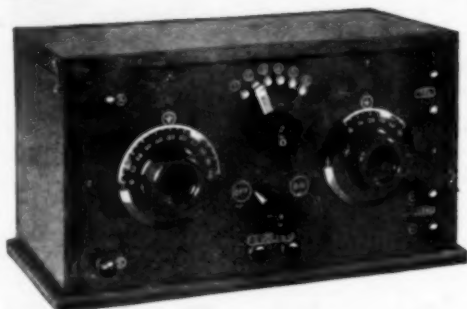
FORMICA

Made from Anhydrous Redmanol Resins

SHEETS TUBES RODS

TUSKA

**Type
224**

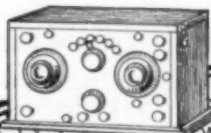


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Type RT-1, for the amateur and broad-casting range, 175-500 meters.

(Patent Pending)

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Will work on all tubes.

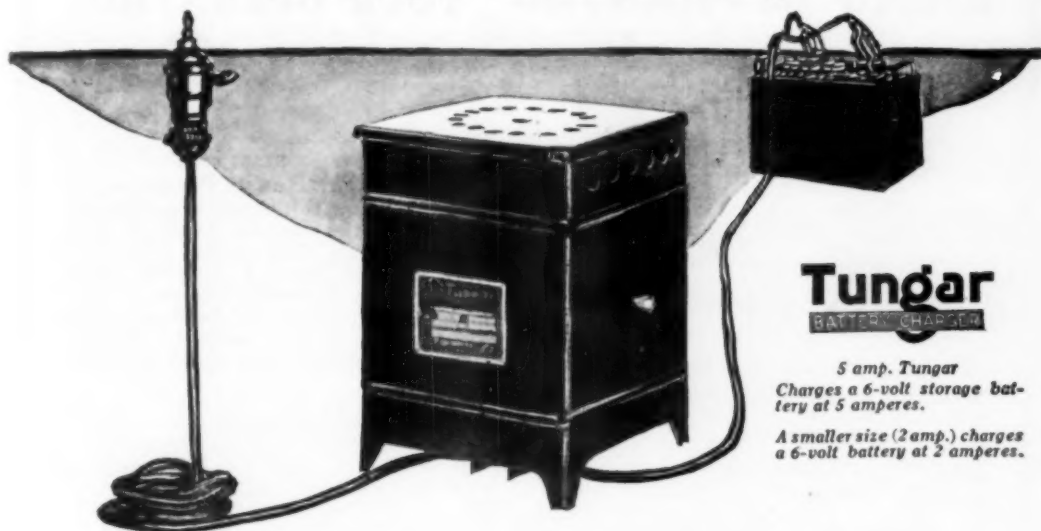
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BATTERY CHARGER

*5 amp. Tungar
Charges a 6-volt storage bat-
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*A smaller size (2 amp.) charges
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Without taking the battery out of the house—in fact, without moving it at all—you can charge it easily and quickly at a minimum of expense, trouble and lost time.

Isn't this much better than taking the battery to a charging station, leaving it a day or two, paying from 75¢ to a couple of dollars and then carrying it back again?

The Tungar is a small, compact rectifier which connects to any a. c. lighting circuit wherever there is a socket or receptacle and requires no attention while operating. Its first cost is not high and it can be operated by anyone without the slightest danger of injuring the battery. Send for new radio booklet and prices.

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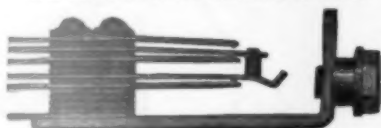
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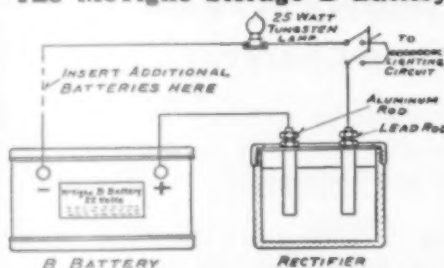
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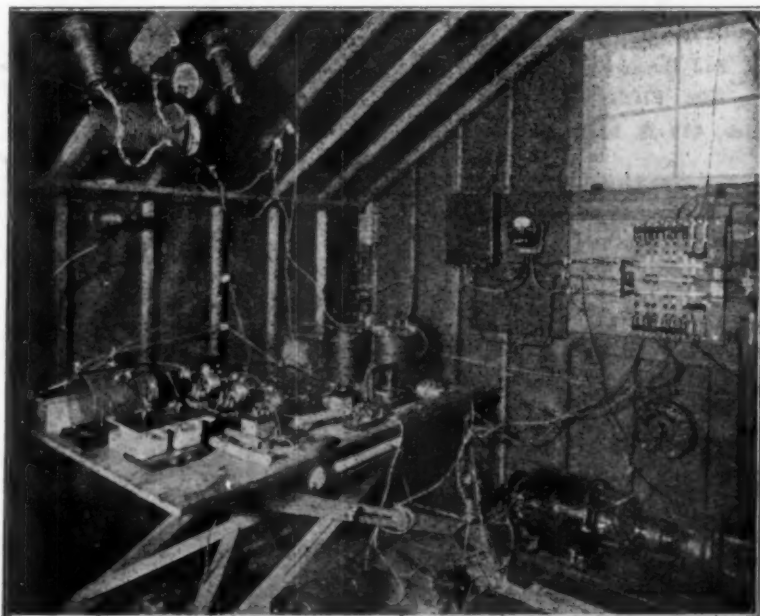
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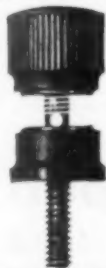
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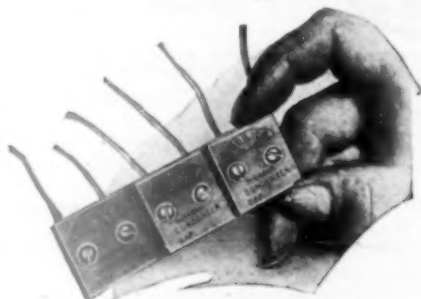
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Two remarkable mica condensers

Use Micadons Type 601 Like Building Blocks



Dubilier Micadon Type 601 is here shown one-third full size. It has the same perfect mica insulation, the same *perma-ent capacity* that has always characterized the famous, larger standard Dubilier mica condenser.

Dubilier Micadon Type 601 is only a little larger than a postage stamp. Micadons Type 601 can be used to build up capacity as if they were building blocks. Simply add one to the other with a few machine-screws, and you pile up any desired capacity. Connect them in series or multiple.

Buy Micadons Type 601 by the dozen, and keep them on hand.

The capacity ranges from .005 to .0001 mfd. Price 35 cents each. By the dozen \$4.00.

Make Your Own Grid-Leak with a Lead Pencil



Sandpaper the surface of Dubilier Micadon Type 601 between the terminals. Next rub point of an ordinary black lead pencil over the roughened surface as here shown. To adjust the grid-leak

thus made rub away as much of the graphite that has been deposited as may be necessary.

Every tube should have an *adjusted* grid-leak, and this is the way to make one simply and cheaply.

Why Tubes Howl

Faulty condenser construction interfere with the reception of broad. The alternate layers of insulating contract with the oscillations of cur often as a million times a second. The tube responds with howling.

Micadons Have

Dubilier patented Micadons have experimenting to overcome this dif made like the famous, larger Dubi standard equipment by ninety-five radio companies of the world.

This means that in the Dubilier conducting layers have been pressed mass. The air has all been squeezed and contraction of the layers. The Tube noises, due to poor condenser

Dubilier Micadons last indefinitely. densers do.

Amazingly

Dubilier Micadons are amazingly est receiving condensers ever pro mand for inexpensive mica con with the cheapest or the most costly

Two types of Dubilier Micadons They are pictured and described on

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Examine your set and see if it has are not receiving broadcasted news

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for 35 cents to \$1.00 each

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causes many of the noises that incasted music and entertainment. and conducting material dilate and rent in the antenna—sometimes as The capacity varies correspondingly. whistling and sputtering.

Permanent Capacity

been developed after long and costly ficulty. They are *mica* condensers lier mica condensers adopted as per cent of the governments and

Micadons both the insulating and together so as to constitute a single out. Hence there can be no dilation capacity is *absolutely permanent*. construction, are impossible.

They will not burn out, as paper con-

Low in Price

low in price. Also they are the small-duced. They meet the popular densers which can be used either receiving set.

are made—Type 600 and Type 601. these pages.

follow the government's example. your protection and applied only to densers.

Dubillier Micadons. If it has not you and music perfectly.

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Here we show Dubillier Micadon Type 600 one-half full size. It is a perfect Dubillier *mica* condenser, especially made to improve broadcasting reception. It costs no more than an ordinary grid-leak holder.

Dubillier Micadon Type 600 lasts indefinitely. Its capacity is *permanent*. There can be no variations and no leakage.

Dubillier Micadon Type 600 is provided with Fahnestock connectors and grid-leak clamps. The grid-leak can be easily removed and replaced with the fingers.

Everything is soldered. The container is of molded composition. Provision is made for holding screws.

Use a Crystal Detector Instead of the Grid-Leak

It is easy to substitute a crystal detector for the grid-leak if desired. Thus it becomes possible to use Dubillier Micadon Type 600 with crystal detector sets and obtain all the benefits that follow when a perfectly constructed *mica* condenser is used.

Price of Dubillier Micadon Type 600 in capacities ranging from .001 to .005 mfd. 75 cents each.

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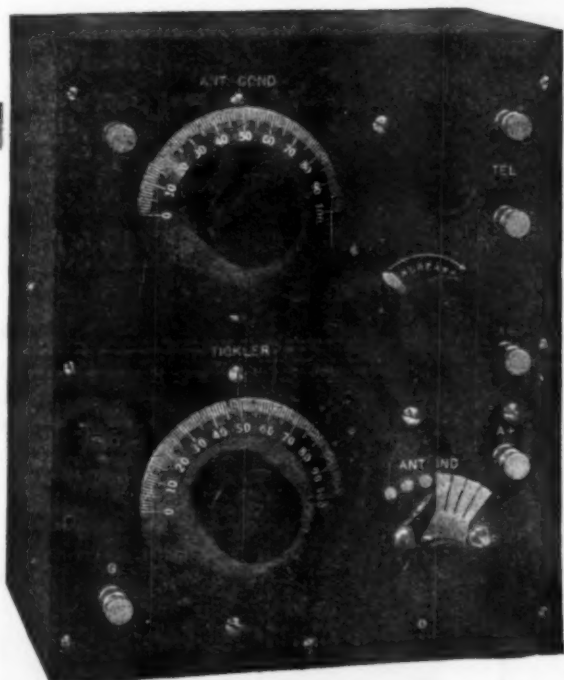
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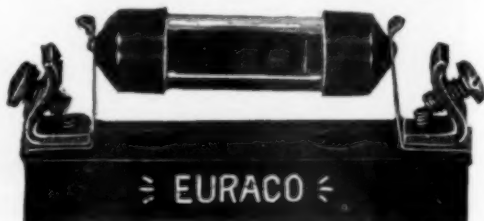
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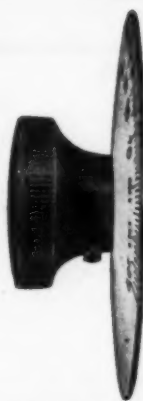
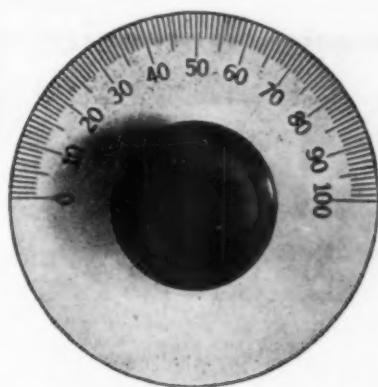
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J-RAY WHITE ENAMELED DIAL VITREOUS WHITE PORCELAIN-ENAMEL ON COPPER

We herewith present our beautiful new white enameled metal dial, with heavy black engraved scale, fused into the enamel under heat treatment.

The smooth white watch-face enamel finish of this dial is unexcelled by any now offered. Besides its beautiful appearance against the conventional black Receiving Panels, our dial, due to its metallic construction, acts as a shield against body capacities. This feature alone is a most important reason why you should use the J-Ray Dial as those who are familiar with the annoying body-capacity effects will testify. Dial will not crack, warp, rust, change color, tarnish or grow dim with age. Lasts and maintains its new appearance forever.

Center of dial is raised or domed as per the conventional type.

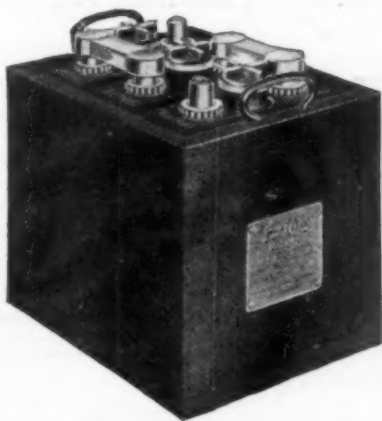
Knurled Black Composition Knob completes the dial's beauty and finish.

Diameter of Dial 3 in. Diameter of Knob $1\frac{1}{4}$ in. Center Bushing for $\frac{3}{8}$ or $\frac{1}{2}$ in. shaftings. Price, complete with knob \$1.00. Without knob \$0.50.

Send for Bulletin 3 describing the above Dial and our Receiving Apparatus.

Dealers—We can make prompt shipments on Dials in any quantity. Write for attractive proposition

THE NEW EXIDE RADIO BATTERY IS NOW READY!



When the evening meal in countless homes is finished, the family settles itself comfortably in the living room for an evening's entertainment by wireless telephony.

The instrument is set up, a dial is turned, and from a distant city the voice of an operatic star fills the room. Or, at another turn of the dial, bed-time stories for the children are heard. Again, the strains of a church organ, the voices of the choir as well as the sermon, are heard from some church many miles away.

But to insure maximum enjoyment from any radio outfit, an absolutely dependable storage battery is essential—a battery designed to provide steady current—a battery whose voltage will not drop after a few minutes' use and necessitate frequent adjustments of the apparatus.

To meet these demands the Exide Radio Battery has been built.

From its practically unbreakable jars to its bolt connector terminals, every detail of this battery reflects the intimate knowledge of storage batteries which its builders possess.

The splendid results obtained with the Exide Radio Battery can be definitely attributed to the long experience behind it. For in the thirty-four years that Exide Batteries have been built for every purpose, much has been learned that was applied in designing a battery specifically for radio work.

Plates that insure long life without reducing their activity; wood separators of the type that have proved

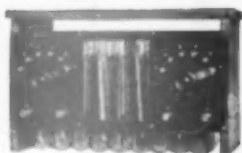
so successful in the famous Exide automobile batteries; jars that will withstand an unusual amount of hard usage; and terminals that insure perfect contact through the simple tightening of a nut—these are briefly, some of the features of the Exide Radio Battery.

The following table shows the four sizes in which this battery is made, with ampere-hour capacities ranging from 20 to 120, according to the number of plates. The over-all height of the battery is approximately 9 $\frac{1}{2}$ inches; the width, 7 $\frac{1}{8}$; while the length, varying with the number of plates used, is given in the following table:

Type	Cat. No.	Length	Weight	Capacity	Price F.O.B. St. Louis, Mo.
3-LXL-3	13735	4 $\frac{1}{8}$	15 $\frac{1}{2}$ lbs.	20 amp. hrs.	\$13.75
3-LXL-5	13736	5 $\frac{1}{8}$	24 $\frac{1}{2}$ lbs.	40 amp. hrs.	17.85
3-LXL-9	13737	9 $\frac{1}{8}$	42 $\frac{1}{2}$ lbs.	80 amp. hrs.	23.46
3-LXL-13	13750	12 $\frac{1}{8}$	59 $\frac{1}{2}$ lbs.	120 amp. hrs.	30.60

Distributed By

J-RAY MFG. CO., 1618 Chestnut St., St. Louis, Mo.



Storage Batteries

Designed Especially For

WIRELESS

"Cheapest in the long run"



KICO "B" BATTERY

The Kimley nickel iron type, alkaline storage "B" battery has long since passed the experimental stage, and the purchase of one will solve your "B" battery troubles for years to come. There can be no sulphating or buckling of the plates. They are not harmed by short circuits, over-charging or standing idle and will hold their charge one to two years when standing idle. Will last from three to six months on one charge when used in the detector plate circuit and can be recharged in two hours from alternating current with the rectifier furnished with each battery. Will give you a quieter running set and improve your receiving range. They are ideal in your amplifier circuit and also for C.W. transmission. Will give you one and one third volts variation and in addition to the above and many other special features they are very attractive in appearance, being assembled in neatly finished oak cabinets and there is no creeping of the salts or solution. Let us ship you one on a ninety day money back Guarantee so that you can prove the above for yourself. Our prices include rectifier, salts for solution and full directions, nothing else to procure but two quarts of distilled water. Plain batteries with clips for voltage regulation 22 volts \$5.50, 32 volts \$8.00, 48 volts \$10.00, 68 volts \$12.00. Batteries with hard rubber panels and switches for voltage regulation as per the above cut. 32 volts \$11.00, 48 volts \$13.00, 68 volts \$16.00. Circulars and a partial list of satisfied users furnished upon request.

KICO "A" BATTERY

If you want "A" battery comfort, buy one of our Guaranteed KICO "A" storage batteries completely charged ready for use and furnished with rectifier to charge from alternating current at the following prices 6 volt \$19.00, 8 volt \$22.00, 10 volt \$25.00 all 60 ampere hours and will give years of service without having to send out to be recharged.

Circulars furnished upon request.

KIMLEY ELECTRIC CO., 290 Winslow Ave., Buffalo, N. Y.

QST de ANTHRACITE RADIO SHOP, P. O. Box 3, Scranton, Pa., successor to Shotton Radio Mfg. Co., of this city.

We wish to announce that we will carry at all times, a complete line of parts, as well complete sets representing the leading manufacturers.

Service - is our watchword.

A Trial will convince you.

Send 5c. for our catalog of Parts

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These instruments are wound with extra heavy wire to reduce the resistance, and have special long bearings with a spiral spring inserted to insure a perfect and self cleaning contact at all times. The taps on the Vario-Coupler are arranged in two groups. Furnished with round or square base. Variometer as illustrated \$6.00 Vario-Coupler as illustrated 6.00

Round or Square Base

Get them at your dealer's.

SIMPLEX RADIO CO.

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You get the best **RESULTS**
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Stromberg-Carlson Radio Headset

These fine instruments, made by a Company engaged in the manufacture of telephone apparatus for 28 years, bring in the long distance tones with accuracy and distinctness.

They give the fullest measure of enjoyment because of the quality of the tones. Convenient and comfortable. The construction of the Stromberg-Carlson Head Set allows simultaneous use by two observers.

Head Set Receivers

Receivers are equipped with a one-piece bipolar permanent magnet, of high grade magnet steel; provided with phenol fiber spool heads, slotted soft iron pole pieces, corrosion proof diaphragm, enameled copper wire coils. All parts are encased in a receiver shell of cast non-magnetic insulating material, that is unaffected by either moisture or temperature changes. Each coil is wound to 500 ohms. The coils are connected in series. This gives a combined resistance of 2000 ohms.

Price \$7.50 each f.o.b. Rochester, including two head set receivers, head band and forked 5-foot cord.

Send for our Free Bulletin No. 1030-Q, describing the No. 2-A Radio Head Set and other superior apparatus of our manufacture.

The Head Band

A head band is furnished of the spring wire type, covered with heavy brown webbing, correctly shaped, light in weight and comfortable to the operator. Knurled thumb screws are provided on both ends to permit locking the adjustment after it is once fitted to the head. There is also provision for separating the receivers which permits two observers listening in on a circuit simultaneously.

The Cords

Each No. 2-A Radio Head Set is equipped with a 5-ft. brown silk moisture proofed, receiver cord which is forked in two branches, one branch for each receiver.

STROMBERG-CARLSON TELEPHONE MFG. CO.
ROCHESTER, N. Y.

Branches: Chicago, Kansas City, Toronto, Address nearest office.

Complete your Wireless Outfit with a BRISTOL LOUD SPEAKER



TRADE MARK
AUDIOPHONE

PATENTS PENDING DESIGN PATENT PENDING

for Radio - Phone
RECEPTION

Can be used on 40 volt 2-stage amplifiers. Reproduces music and speech without distortion. No Batteries Required. Everyone can hear the wireless concerts, speeches, news, etc. A marvel of simplicity. Only one moving unit, comprising a diaphragm and an armature directly attached to it. Horn 15 inches diameter—compact, artistic design.

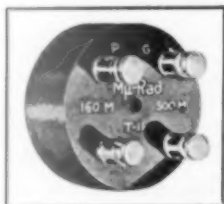
PRICE COMPLETE\$40.00

Made and Sold By

THE BRISTOL COMPANY
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R. F. AMPLIFIER TRANSFORMERS

MU-RAD



TYPE T-11 for single or multi-stage\$6.00
TYPE T-11a especially for second stage 6.50
TYPE T-11b especially for third stage 7.00

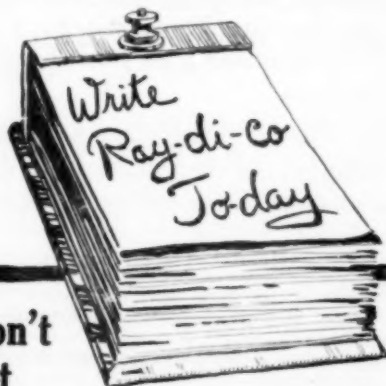
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ST. LOUIS, MO., ASBURY PARK, N. J.

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**Don't
Let**

Dissatisfaction and lost Radio business remind you next month, to place your orders with RAY-DI-CO.

DO IT NOW!

RAY-DI-CO ORGANIZATION USE THIS COUPON
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Send me prices and information on the following Radio Apparatus:

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Give Your Radio Set the Advantage of

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RADIO BATTERIES



Westinghouse "A" Batteries are especially built for the peculiar requirements of radio work. They deliver a constant, dependable flow of low voltage current. They are built to give long, low-cost service. They demand a minimum of attention.



In the Westinghouse "B" battery you have a *storage* battery for "B" work—the latest development in radio practice. It has all the reliability and dependable performance of a storage battery and none of the disadvantages of a dry cell. The Westinghouse "B" gives a steady, continuous, noiseless service. It lasts indefinitely. When exhausted it is easily recharged. The first cost is the last cost.



14½ in. long
2½ in. wide
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Don't lose the enjoyment of your Radio by operating under unsatisfactory battery conditions. Get Westinghouse "A" and "B" batteries from your radio dealer or the nearest Westinghouse Battery Service Station.

*"The best
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Complete List of all Amateur Stations in the United States, including Special and Broadcasting Stations.

Notes on the construction of a complete receiving set.
Calibration of a receiving set without the use of a wavemeter.

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KECO-RADIO STORAGE BATTERIES



Are the highest grade batteries built especially for wireless instruments.

Solid oak box, natural finish, highly varnished. 6 volt, 7 heavy "Cristol" plates per cell, 50 amps.

We are one of the largest builders of exclusive high grade Wireless Batteries in the country. Thousands in use. Sold by all leading dealers or shipped direct from factory, \$15.50 with book of uses and abuses of the storage battery.

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Radio panels

HAVE your panels made to your own specifications. Celoron Radio Panel Service assures you the highest type, best serving, best looking radio panels made, machined and engraved to your own individual specifications.

CONDENSITE CELORON

Grade 10—the highest type of radio insulation that we produce—has a wide variety of uses in the radio field. It is extremely high in surface and volume resistivity, high in dielectric strength and low in dielectric losses. This material is particularly suited for panels because it machines easily, engraves beautifully and is extremely handsome in appearance. It is the grade we recommend, and has been approved by the Navy Department Bureau of Engineering.

Where economy is a factor we can supply panels made of Vulcanized Fibre Veneer. This material is made of a center section of hard, grey vulcanized fibre veneered on both sides with a water-proof, phenolic condensation product. It has a fine, smooth, jet black surface, machines readily, engraves nicely and is applicable for use in the construction of radio equipment where very high voltages at radio frequencies are not involved.

Celoron Shielded Plates (patent applied for) are made with a concealed wire mesh imbedded directly under the back surface of the plate. This wire shield, when properly grounded, very effectively neutralizes all "howl" and detuning effects caused by body capacities. Shielded plates are made in both Condensite Celoron Grade 10 and Vulcanized Fibre Veneer.

Send today for our Radio Panel Guide

Are you an enthusiast? Write to-day for our Radio Panel Guide that describes these panels in detail—quotes prices—and tells you just what the panel you want will cost.

Are you a Radio Dealer? Get in touch with us. Learn how easily Celoron Radio Panel Service enables you to sell panels completely machined and finished to your customer's specifications. No waste, no bother. Write for our special Dealer Proposition to-day.

Diamond State Fibre Company
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Type TIA, Flush Model

If You NEED a Voltmeter

You PAY for it

Whether you BUY it or not

For Instance: If you put too much voltage on the filament of your V.T. you burn it out. Result—a new tube, which costs about the same as a Roller-Smith voltmeter. So you see you **do** pay for the voltmeter whether you buy it or not.

Bulletin No. AG-10 tells you all about Roller-Smith voltmeters for reading filament voltage. It also describes a complete line of 3½" A.C. and D.C. instruments for all radio work. Send for it. **It's Free.**

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10c. Charges 'A&B' Storage Batteries WITH AN F-F Booster

So You will never have to give up, in disgust when working a distant station. Is it not gratifying to feel that your filament battery will always be ready when you want it? You know what it is like to have friends call to "LISTEN IN" & then find your battery dead. The AMMETER shows you the amount of Current Flowing. Both Waves of Current are rectified thru adjustable & easily renewable Carbon Electrodes, which maintain a constant efficiency & last indefinitely. Each F-F Battery Booster Type is in itself a Complete Compact Self-Contained & Portable Magnetic Rectifier & Charging Unit, for 105-125 Volt 60 Cycle A.C. which Operates Automatically & Unattended. Screw Plug in Lamp Socket, Snap Clips on Battery Terminals & watch the Gravity come up. **PRE-WAR PRICES:**

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The Large Types are for heavy Batteries, or Where Time is Limited. Shipping Weights Complete 12 to 15 Pounds. Order from Dealer, or send check for Prompt Express Shipment. If via Parcel Post have remittance include Postage & Insurance Charges. Or have us ship C.O.D. Other F-F Battery Boosters charge Batteries from Farm Lighting Plants & D.C. Circuits & for Group Charging & Wireless High Voltage Rectification

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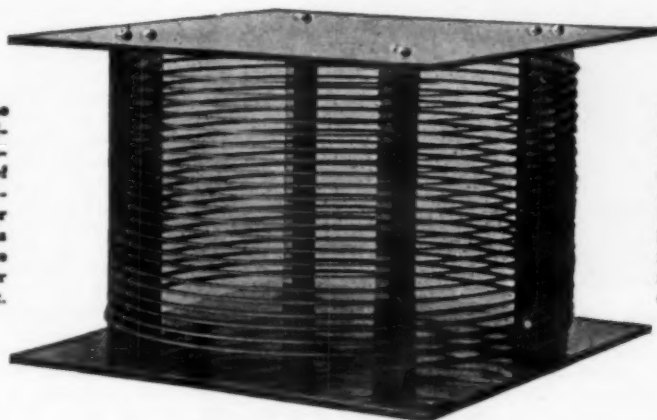
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We can't make ALL of the radio apparatus — so we just make the BEST of it

The use of the WIMCO INDUCTANCE assures you of maximum results from your CW outfit. Its low resistance means greater antenna output.



Used everywhere where the best apparatus is desired. Order from your Dealer. Price 25 turn size \$10.00, Grid Coil \$2.00 extra.

WIMCO CW 100 INDUCTANCE

The following data on the resistance of the WIMCO C.W. INDUCTANCE was furnished by the Washington Radio Laboratories, Washington, D. C. It was measured for ten turns, this being the average number of turns in use on most amateur aerials at 200 meters wave length;

Wave length	H. F. Resistance
150	.71 ohms
200	.85 ohms
250	.95 ohms

(effective inductance 80.5 microhenries at 200 meters)

Full description of this inductance, and circuit diagram is contained in the WIMCO catalog, mailed anywhere on receipt of 15 cents in stamps.

ANNOUNCING THE "STANDARD" AUDIO FREQUENCY AMPLIFYING TRANSFORMER. We are distributors for the new Standard amplifying transformer designed for Cunningham and Radiotron tubes, 9 to 1 ratio, equal to any transformer on the market, and are in position to make immediate deliveries. Price \$5.00 fully mounted and thoroughly guaranteed. DEALERS—JOBBERs WRITE.

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MULTIPLE WAVE TUNER

This tuner will be shipped anywhere in the United States upon receipt of one third the purchase price. Examine the instrument carefully and if acceptable, remit the balance. If you are not perfectly satisfied, simply return the instrument and we will refund your deposit. If you do not wish to order at once, send a stamped return envelope for our literature describing the complete line of Standard instruments.

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*We carry at all times a complete stock
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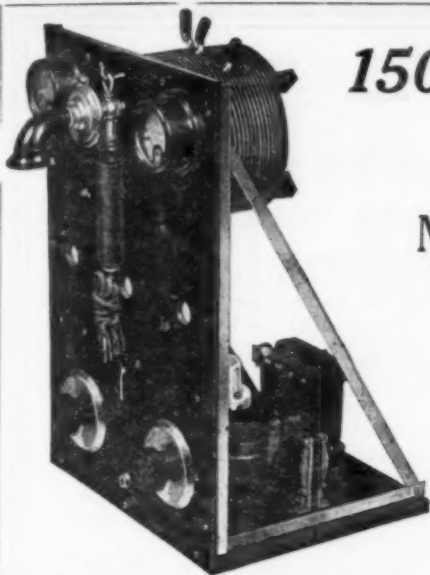
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1500 Miles With CW!

1100 Miles Voice!

**Music Heard 40 feet from
Phones by Stations in
300 to 400 Miles Radius**

These are actual results obtained by our testing station 9ZB, using this set. You can get just as good work out of it.

The Benwood Wireless Telephone

*For CW, ICW, Modulated Buzzer and
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This high class set is just the thing for your broadcasting and DX work. An ideal set for the local radio club or the more progressive amateur. Think of the range this set will give you! If centrally located, you will be heard in almost every state in the Union.

It is manufactured exclusively by and for the Benwood Co. and combines the best in material, workmanship and design.

Radiates 1 1-2 to 3 Amps.

We guarantee that this outfit will radiate $1\frac{1}{2}$ amperes on the average amateur antennae when assembled in accordance with our instructions. It will radiate 2 to 3 amperes when used with an antenna whose fundamental wave length is 225 to 275 meters. That is why you can get such wonderful results.

Specifications

The set comes to you completely assembled with all parts mounted on panel, as shown, but not wired. Full instructions and wiring diagrams are furnished. You can wire it and start sending in less than an hour after you receive it.

The outfit is complete with motor generator, minus tubes, and consists of the following:—

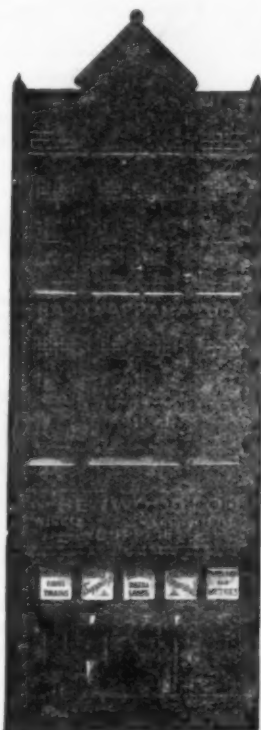
Panel $12 \times 18 \times \frac{1}{8}$, angle brass supports, hardwood base, 3 tube sockets, 1 power rheostat, 1 80 watt filament trans., 1 modulation trans., 1 CW inductance, 1 hand transmitter, 1 0-3 Radiation meter, 1 0-500 milliammeter, 1 21 plate condenser, 1 43 plate condenser, 1 tapped condenser, 1 L-300 choke coil, 1 2000 volt filter condenser, 1 10,000 ohm grid leak, plug and jack connection for microphone buzzer and CW, 1 600 volt 220 watt motor generator. Boxed for shipment, \$200.00 f.o.b. St. Louis, Mo.

Send for Catalog

Send 10c in stamps for the new Benwood Radio Catalog comprising the latest Price Directory.

**THE BENWOOD CO., INC., 1114 OLIVE STREET,
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"WORLD WIDE MAIL ORDER SERVICE"



The above photo shows our new 3 story building in the heart of the St. Louis business district. Our mail order department is complete in itself and we give you immediate service on all mail orders.

Here at Last — The

radio head set you have been waiting for-



Superior Features—

Lightweight—12 oz.
Extremely Sensitive
No Distortion
Anchored Cords
Matched Receivers
Centered pull on Diaphragms
No hair catching projections
Small—Compact
Maximum Efficiency

Backed by years of experience in the making of voice reception apparatus this head set is the last word in unequalled distinctness, extreme sensitiveness and pure, clear tonal qualities.

Your receiving outfit equipped with this radio head set will assure you of maximum service in faithfully reproducing all broadcasted vocal and musical sounds.

The sanitary headband is self-adjusting, with a spring tension that automatically takes up the wear. The wearer is assured of the greatest comfort with minimum surface pressure. The removable interiors are entirely insulated from the case and allow for temperature changes.

Give yourself a treat—try them—you will find they are all we claim—and more.

Dictograph Products Corporation
220 West 42nd Street, New York, N. Y.

ACE "ACE RADIO CONCERT RECEPTOR" ACE



Type TRU Concert Receptor \$50.00

(Licensed under Armstrong Patent 1,113,149)

This unit is especially designed for the efficient reception of Radio Telephone Concerts from even the most distant Broadcasting Stations. The ease with which this Receptor can be installed and the extreme simplicity of operation make it ideal for use by even the most in-experienced. No previous knowledge of radio necessary to secure results.

We stock a complete line of Radio Supplies and maintain a prompt, reliable Mail Order Service that reaches all over the world.

Send 5c in stamps for catalog to Dept. "D".

The Precision Equipment Co., Inc.

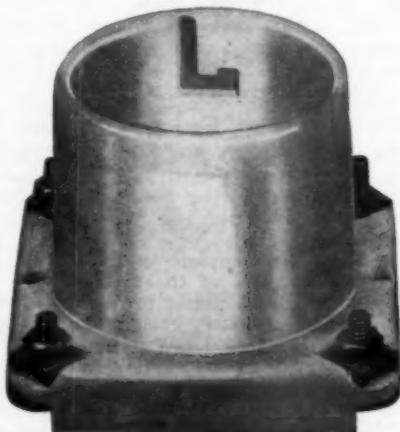
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50 cents each



The original socket with the concealed bayonet slot.

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Ask Your Dealer or Write Direct to:

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Above All

Quality is the wave length to which the wise consumer tunes today, in his purchase of radio equipment. He buys quality apparatus because he knows it produces quality results—constant, unvarying efficiency under ordinary conditions, anywhere.

It has been the privilege of the Marshall-Gerken Company not only to manufacture quality wireless apparatus, but to show users the value of quality in radio instruments. They have expressed their ideal of quality in the precision required of their engineers in the making of the smallest as well as the largest part; quality construction is the key to the facility of operation of Marshall-Gerken apparatus; the factor of quality again predominates in the simplicity of the instructions by which the amateur as well as the professional obtains the highest utility from Marshall-Gerken equipment.

In the establishment of their nation-wide reputation for making and selling only thoroughbred apparatus, the Marshall-Gerken Company have set a high standard by which to test superior endurance and unusually satisfactory service of radio equipment.

Progressive Distributors and Dealers: Write for our illustrated Booklet, you will find it exceedingly interesting.

The Marshall-Gerken Co.

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Toledo, Ohio, U. S. A.

THE THORDARSON AUDIO FREQUENCY AMPLIFYING TRANSFORMER

is now standard with many well known manufacturers
That should be sufficient guarantee that it is right

**SHELL
TYPE**



**PRICE
\$4.50**

Each transformer supplied fully mounted in an ingenious, nickered frame with substantial terminals mounted on a bakelite terminal board.

The terminal board is on the top, the only logical place for a terminal board. The transformer is wound with silk covered wire.

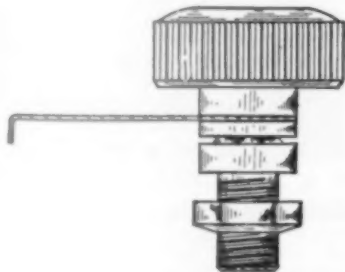
BACKED BY THE "GOLD MEDAL" LINE
PRICE, AS ILLUSTRATED \$4.50

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Hi-Grade Radio Accessories



BALL BEARING SWITCH \$0.50
PROMPT SHIPMENTS

SWITCHES, CONTACTS, BINDING POSTS,
SWITCH STOPS, BUSHINGS, WASHERS, NUTS,
SCREWS, SPECIAL BRASS TURNED AND
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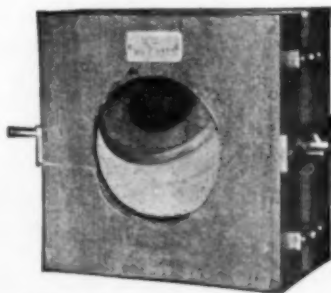
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534 Manor St., Lancaster, Pa.

Representing the G. B. Fenstermaker Line,
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Dealers and manufacturers write for proposition.

TUNESHARP VARIOMETERS-VARIOCOUPLERS



VARIOMETERS, complete \$5.00
VARIOCOUPLERS, complete 4.00
VARIOMETERS, unassembled 4.00
VARIOCOUPLERS, unassembled 3.00
(Include Postage on 4 Lbs.)

KNOCKED-DOWN SET \$10.00
Two Variometers and Variocoupler
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AEROPLANE ANTENNA WIRE
\$1.00—Per Coil of 200 Feet—\$1.00
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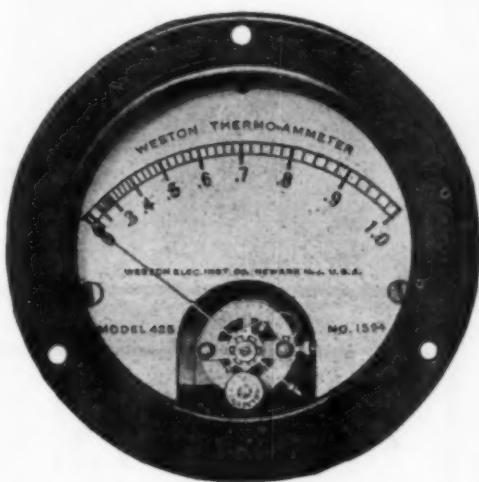
We also carry a complete line of radio receiving
sets from \$25.00 to \$300—let us know your needs.
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LINZE ELECTRICAL SUPPLY CO.
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"How Do I Come Through? I Can't Depend on My Ammeter!"

You never hear such statements from users of the

Weston Thermo-Ammeter



This Instrument has made the measurement of high frequency currents as simple and reliable as any ordinary electrical measurement.

It is free from all the objections and uncertainties of the "hot wire" types.

It is highly accurate; thoroughly compensated against temperature or working errors; it is instantly responsive; it has no zero error or lag, and is designed and built to give permanent satisfaction.

It is a truly scientific Instrument and is the most economical type that can be used in the antennae.

This Instrument is in service in many thousands of Transmitting Sets, including most governmental, commercial and marine outfits, and is now being bought in large quantities by amateurs and experimenters to replace unsatisfactory types.

Complete information concerning this particular Instrument and the complete group of Weston Radio Instruments is contained in "Circular J." Write for it. If your dealer cannot supply your needs from stock, we shall be glad to do so.

WESTON ELECTRICAL INSTRUMENT CO.

158 Weston Avenue, Newark, N. J.

Branch Offices in the Leading Cities



We are the Designers, Originators,
Manufacturers and Distributors of

The Bell Buoy Binding Post

(Removable Head)

The Binding Post for Land and Sea.

The Peer of all Removable Head Binding Posts. Has the Vise-Grip.
Wire will not turn. We leave the Question of its Superiority to You

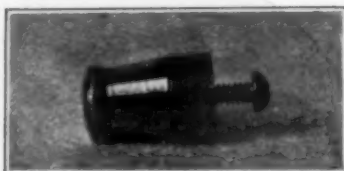
15c EACH—12 FOR \$1.75 P.P. PREPAID.

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Amateurs Send for Circular.
Dealers Send for Our Proposition.

Star Cabinet & Radio Shop

G. W. Calvert, Mgr., Dept. 2
LANSDALE, MONTGOMERY CO., PA.
(Binding Post Specialists & Experimenters)



We offer for the first time a special
**CORRESPONDENCE
COURSE in CITIZEN RADIO**

giving complete non-technical instruction in
fundamentals of Radio and practical explanation
of "hook-ups" and a hundred details
amateurs need to know.

Send 25c in stamps for first lesson

The surplus of experienced commercial
operators being absorbed, our school is
again in position to guarantee positions
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now open. Our school has most successful
record. Send for catalog.

**MASSACHUSETTS RADIO and
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Leading Jobber !

We are marketing the Radio Ma-
terials of the old time Manufac-
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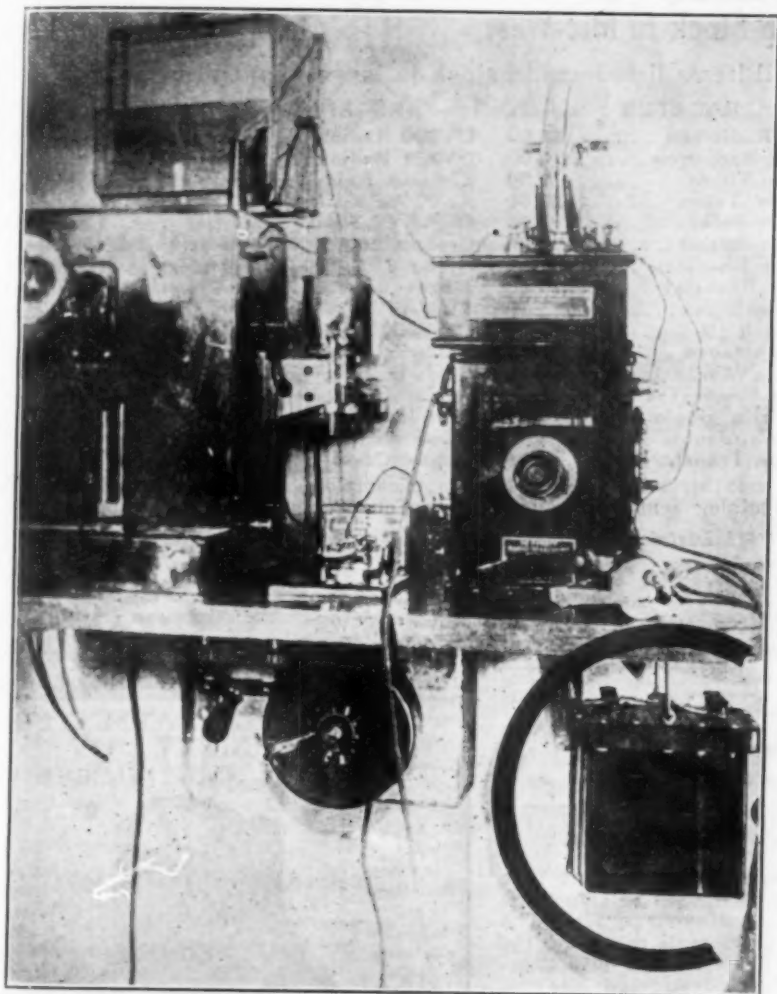
Standard Radio Merchandise at
correct prices

Detroit Electric Co.

113-115 E. Jefferson Ave.
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"EXCLUSIVELY RADIO"

WITHERBEE



TRADE
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**First
Wireless
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Set
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A
BATTERY
Is the
Sole Source
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Extra heavy plates and separators permit continuous complete discharges at constant voltage without harm.

One piece hard rubber case insures against damage from leaks and is absolutely clean. Built by pioneers—1903-1922.

For information for the trade write

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T & H Radio Company

Largest Radio Stock In Mid-West

Immediate Deliveries

All items listed are in stock in large quantities.

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UV202 5 watt Radiotron	\$8.00
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UR542 Porcelain Socket	1.00
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Grebe CR9 with amplifier	130.00
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Grebe CR5 150-3000 meters	80.00
Magnavox, 14" horn	45.00
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Burgess Tapped "B" Battery ...	2.75
Baldwin Receivers type C	12.00
Baldwin Receivers type E	13.00
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Acme Amplifying transformers ..	5.00
Honey Comb Coils, all sizes	

Inquire for monthly stock sheet, shows our complete stock each month. CW and radiophone catalog sent any address when four cents in stamps accompanies inquiry.

5th District Distributors for Ideal Apparatus Co.

T & H Radio Company

ANTHONY,

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KANSAS

HI-GEE PLUGS and JACKS

Now ready for delivery—

Jacks	80c each	\$1.35
Plugs	70c each	

Combination set of one plug and one jack. This is a special limited offer for short time only. We positively guarantee to ship these one hour from receipt of your order. The most efficient and serviceable plug on the market. Both units are attractive in appearance and are sturdily constructed.

HI-GEE AUDIO FREQUENCY AMPLIFYING TRANSFORMERS

Fully assembled and mounted. Made of the best materials. Correct ratio of primary and secondary turns. Silicon steel core. The best Audio Frequency transformer on the market, selling at a popular price

Special 30 day offer. \$3.30

We offer for immediate delivery the following: Parkin Dial Rheostats, Vacuum Tubes, Klossner Vernier Rheostats, Head Sets, HI-GEE Variable Condensers, Grid Leaks, HI-GEE Variometers & Couplers, Grid Condensers.

12 page loose leaf catalogue now ready

Write for your copy NOW

HI-GEE Pays the Postage

**HI-GEE RADIO MANUFACTURING
Marion, COMPANY Illinois**

112

INDIVIDUAL BATTERY CHARGING AT LAST PRACTICAL AND EFFICIENT

For
Charging
Radiophone
and
Automobile
Batteries
from
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Initial
charging
Rate
6 volt
Battery,
10
amperes

THE

Sterling
Portable Rectifier

THE Sterling charges a nearly exhausted battery over-night for a few cents. Improved vibrating reed type, simple, effective and durable. One thumb-screw does all the adjusting. Automatically tapering charge safeguards against overcharging.

Price Complete - - - \$16.00

West of Rocky Mts. - - - 17.00

Write for Bulletin giving full information.

THE STERLING MFG. CO.
2834 Prospect Ave., Cleveland, Ohio.
Over two million Sterling
Instruments in use today.

ALWAYS MENTION QST WHEN WRITING TO ADVERTISERS

Meeting the Demand for Radio Sets

IT is natural that broadcasting, *carrying news, music, lectures, concerts and even grand opera* into the homes of the American people, should have created a concerted and impatient demand for radio sets and apparatus—especially, the popular radio receiving sets.

If the demand for radio sets and apparatus had grown normally, the well-equipped and highly-organized factories supplying the Radio Corporation of America would now be producing an excess over the market requirements.

Under the present expansion program of the Radio Corporation of America it is quite possible that there will be a surplus production within six months.

A Greatly Expanded Program

The factories manufacturing for the Radio Corporation of America are operating on a greatly expanded production program. *They are straining every nerve and muscle to meet the demand.*

It is not merely a question of men and raw materials. There are limiting factors in some of the delicate equipment parts, and even when all production is running evenly, new jigs, dies and tools must be especially designed, manufactured and installed before the production forces can be increased.

As a result of the efforts that are being made, it is expected that within the next few weeks considerable quantities of material will be shipped on orders already placed. This applies to all classes of radio sets and apparatus, and especially Radiotrons, Vacuum Tubes, etc., which are employed for reception.

The assurance can be given that every scientific, manufacturing, organizing and financial resource of the Radio Corporation of America is being used to meet the demand for radio devices.

We are working to the utmost, not merely to supply the demand, but to put into every set and every piece of equipment complete quality, and as much permanent satisfaction as a rapidly developing art will permit.

We are asking the aid of our distributors and dealers in explaining the capabilities and limitations of radio sets and apparatus, and we welcome their co-operation and indulgence, as well as that of the public itself, until the present expansion program is carried out.

A new R. C. A. Catalog, covering all the radio devices being manufactured for the Radio Corporation of America, will be ready for distribution within thirty or forty days. This catalog will contain timely and helpful information of great value to the wholesale distributor, the retail dealer, and the user of radio apparatus.

Radio  **Corporation**
of America

233 BROADWAY ~ NEW YORK CITY
Sales Department Suite 1803

ELWOOD RADIO HEADSETS

The seventeen years of practical experience in the making of telephones and receivers by this company, assures you of good design and workmanship.

Elwood headsets meet the exacting demands of all purchasers of radio units and parts. Both receivers operate in unison, insuring clear, harmonious and uninterrupted reproduction. Our absolute guarantee of the ohmage capacity of these headsets is your safeguard.



Receivers have metal case, highly finished. Headbands, have sanitary fabric covering, fully adjustable. Complete set packed in attractive carton.

We are also manufacturers of Binding Posts, Contact Points, Jacks and Plugs for Radio Work.

ELWOOD ELECTRIC CO. INC.

Formerly Liddell Electric Mfg. Co.

2-4 Randall Avenue, Bridgeport, Conn.

ANNOUNCEMENT

Doubleday, Page & Company announce to the readers of QST their new magazine—



It will be unique in the Radio field, in that it will serve the entire Radio Public—and not any single organization, manufacturers, or any other group.

It is not a competitor of QST, and we are sure that readers of QST will find much of interest in Radio Broadcast that they cannot find anywhere else.

Buy it at the news-stands—or better still—send a dollar for four months of the magazine on trial. 104 pages of interesting material.

Address—Subscription Manager.

Doubleday, Page & Co.
GARDEN CITY, N. Y.

ANNOUNCING Our Entry

INTO THE FIELD OF

CITIZEN RADIO

AS

Manufacturers

OF

R E X

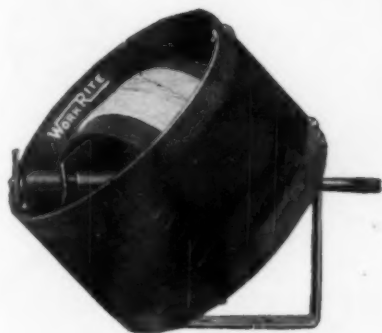
Radio Apparatus

Ask For It At Your Dealers
Dealers—We can make deliveries

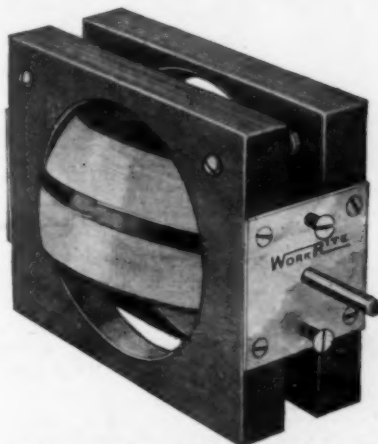
Jenkins Mfg. Co.

4607 Ravenswood Ave.
Chicago, Illinois

"WORKRITE PRODUCTS WORKRITE"



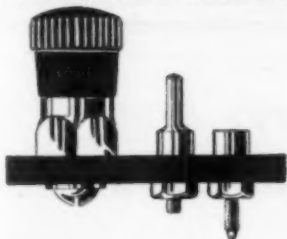
Finest
Material
Finest
Workmanship
Finest
Finish



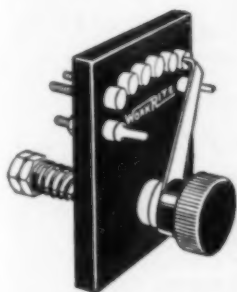
Here is the "Tuner Team" that radio fans have been going wild over wherever shown. Most dealers have their entire allotment sold before shipment is received. "They certainly do WorkRite" is the verdict of all users.

One WorkRite Variocoupler and two WorkRite Variometers are guaranteed to give you a tuner that cannot be excelled by anything on the market.

WORKRITE VARIOCOUPLER OR VARIOMETER IN ATTRACTIVE BOXES \$6.00 EACH



WorkRite Binding Posts.....	\$0.12
WorkRite Switch Points.....	.04
WorkRite Switch Stops.....	.06



Just what you want. Remove the parts and use the block as a template for drilling your panel. Put up in neat individual boxes. Complete WorkRite Switch Sets, \$1.00. Switch arm only, with bushing, 50c.

TYPE "A" WORKRITE HYDROMETER

Double the life of your battery by giving it proper care. Fill and test it regularly with a WorkRite Hydrometer. Never let it become discharged below 1150, or it will soon be ruined. Full instructions for testing and care of battery with each "WORKRITE." Get one now! Price, \$1.00



Insist that your dealer furnish a "WORKRITE." Accept no substitute. If he cannot supply you, we will ship direct by mail prepaid.

JOBBER AND DEALERS—Write or Wire for Discounts

The WORKRITE Mfg. Co., 5603 Euclid Ave.
Cleveland, Ohio.



No. 53



No. 54



NEW RADIO INSTRUMENTS

Pattern No. 53 Triple Filament Ammeter has three self contained shunts with a switch for reading the current in the filament of any tube of a group of three without breaking the circuit. Also supplied as 0-10 voltmeter. Takes the place of three instruments.

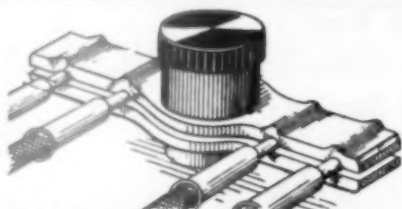
Price, 1.5 Amps. or 10 Volt. \$10.00

Pattern No. 54 double range portable voltmeter for testing "A" and "B" batteries under all conditions commonly used for receiving. Fully described in our new circular with our standard line of radio instruments.

Price, 0-12-120 Volts \$10.00

ORDER FROM YOUR DEALER

JEWELL ELECTRICAL INSTRUMENT CO.
CHICAGO



FOUR SETS OF PHONES!

25c will buy a set of Multiple Binding Post Connections (patent pending) which provide the only practical means of attaching as many as 4 pairs of telephone receivers to a pair of ordinary binding posts.

Dual connection set provides same connection in attaching Magnavox and outfit to storage battery.

Either set will be sent postpaid upon receipt of 25c in coin or stamps. Satisfaction guaranteed or money back.

Portable Wireless Telephone Co

Dep't B, Commercial Bank Bldg.,
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Attractive Dealer's Proposition.

Wireless Amateurs Attention!

If you want service, order from us. We carry a large stock of High Grade Wireless Apparatus of our own and other manufacturers.

SPECIAL!

Vacuum Tube Sockets.....	\$1.25
Rheostats	1.25
22½ Volt "B" Batteries.....	1.50
Rasco Dials60
Rubber Binding Posts.....	.20
Tested Galena40

Lateral Wound Coils. All Sizes.

SEND 5c FOR OUR NEW PRICE LIST

J. M. PAQUIN,

THE ELECTRICAL SHOP

787 Queen St. West, Toronto, Ont.

SHREVEPORT

THE HEART OF THE FIFTH DISTRICT
We stock leading makes of—

RADIO APPARATUS

MAIL ORDERS A SPECIALTY

Shreveport Radio Supply Co.

P. O. Box 600, 222 Texas St., Shreveport, La

SPECIAL PRICES THIS MONTH

On Grebe, Clapp-Eastham and
Amrad Sets

MASSEY RADIO COMPANY

The Radio Store, Winchester, Va.



SIGNAL WIRELESS APPARATUS IS BUILT COMPLETE IN SIGNAL SHOPS

Heed the warning of the radio expert who says—be careful, Mr. Radio Beginner, to prove the quality of your Radio equipment **before** you buy it. Ask who built it—who uses it—how does it compare with other makes at or near its price!

Signal Wireless Apparatus is built complete in Signal factories, by Signal workmen, following tests and developments by Signal and other expert Radio Engineers in the Signal Radio Laboratory. The name "Signal" is the guarantee of satisfactory Radio Service.

Write today for literature and name of nearest dealer.

Signal Electric Manufacturing Company
Menominee, Michigan

HYGRADE SPECIALS

save you money!

22½ Volt Cyclone Small B. Battery ..	\$0.90
22½ Volt Cyclone Large B. Battery ..	1.60
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Bakelite V.T. Sockets69
3 inch Bakelite Dials75
100 ft. #14 hard drawn copper aerial wire45
100 ft. 7 stranded copper aerial wire ..	.75
Binding Posts Rubber Cap per doz. ..	.75
.0005 M.F. Grid Condensers25
.002 M.F. Phone Condensers25

MARKO STORAGE BATTERIES

6 Volt 40 Amp. Guaranteed 2 yrs. ..	\$10.00
6 Volt 60 Amp. Guaranteed 2 yrs. ..	13.50
6 Volt 80 Amp. Guaranteed 2 yrs. ..	17.00
6 Volt 100 Amp. Guaranteed 2 yrs. ..	21.00
Western Electric 2200 Ohm Head Set Complete	14.00
Eveready 0 to 10 Voltmeter, Pocket size75
Variable Grid Leak ½ to 3 Megohms ..	.70
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Per Dozen	3.00
Arkay Loud Speaker	4.25
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We do Not Charge For Crating. The Above Batteries are fully charged when Shipped.

The Above prices are F.O.B. New York.

HYGRADE ELECTRICAL NOVELTY COMPANY
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PSOULIESO

Does not mean anything, but if you want a word that means satisfaction in high-grade radio apparatus, remember

“RADIO  VOX”

Highest grade apparatus only. Ask those who know.

Scientific Engineering Association

817 Main St.
Cincinnati, O.

 **THE O.W.L. RHEOSTAT**

An instrument of real Value, NO THERMO-ACTION resulting in distortion because all parts are made of the same resistance alloy throughout.

PRICE - - \$1.00

1012 Ogden Ave.,

N. Y. City

**RADIO CENTER
SRC
OF THE SOUTH**

SOUTHERN RADIO CORPORATION
Radio Engineers and Jobbers

905 Realty Building.

Charlotte, N. C.

New "Read 'Em" Binding Posts

16 Styles

Antenna

Ground

Condenser

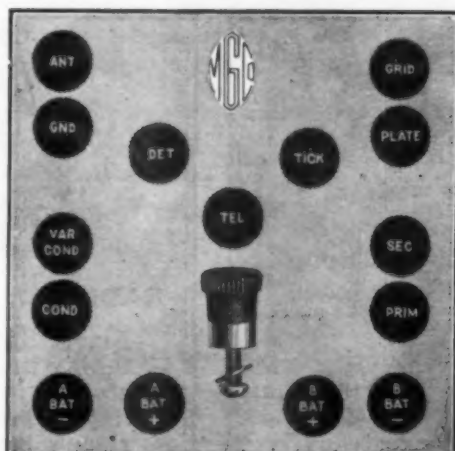
Tickler

Variable Conden-
ser

A—Battery—

A—Battery +

B—Battery—



B—Battery +

Plate

Detector

Phones

Secondary

Primary

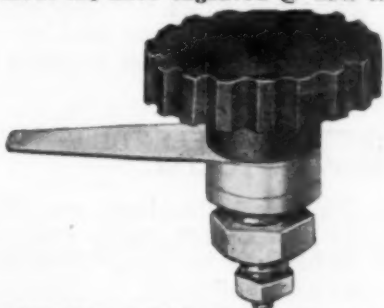
Grid

Filament

Complete Post and Knob 15c each

The enormous demand for these "read 'Em" binding posts, prompted us to put in a large stock to take care of our friends. Our stock is complete.

We are in equally fine position to fill orders promptly for binding posts made up of exactly the same high grade material and workmanship—the same in every way, without the knob engraved @ 12c. each.



SWITCH ARM TYPE S. A. 3

Price\$.50 Each

Knob—1 3/4" Knurled Bakelite

Lever—1 1/2" Phosphor Bronze Nickle

Bushing—to fit up to 3/8" panel.

Type S. A. 1—Price.....\$.40 Each

Same as above with 1" radius knob.



SWITCH ARM TYPE S. A. 4

Price\$.50 Each

Knob—1 3/4" Fluted Bakelite

Lever—1 1/2" Phosphor Bronze Nickle

Bushing—to fit up to 3/8" panel.

Type S. A. 2—Price.....\$.40 Each

Same as above with 1" radius knob.

Send Us Your Orders Now

Orders will be shipped the day they are received. Send in your order early.

THE KUEBLER RADIO COMPANY

125 Boody Bldg.

Toledo, Ohio



ATTACHED to any commercial receiving set, the Magnavox Radio reproduces every sound in full volume and marvelous clearness.

Magnavox Radio, the loud-speaker, that has revolutionized the use and enjoyment of wireless telephony.

Ask your dealer to demonstrate, or write us for descriptive booklet.

The Magnavox Company
Oakland, California
New York Office: 370 Seventh Ave.

Radio brings it,
MAGNAVOX
tells it.

IRVINGTON Radio Products



RADIOCEL TUBES

Black seamless impregnated tubing in all lengths and diameters, with $\frac{1}{8}$ " wall, for Tuning Coils, Loose Couplers, Variocouplers. Most economical tube form for all type of sets, for winding forms, at one-quarter the price of Bakelite.

RADIOLAC

Insulating and finishing varnish for wound forms. Will set and insulate all wires and air dry in 15 minutes. In $\frac{1}{4}$ pints and up.

IRVINGTON FLEXIBLE WOVEN TUBING

To fit all standard size wires, in four colors, made and guaranteed by us, large production capacity.

Prompt shipment—high grade insulation goods sold at quantity production prices. Prices in any quantities.

Sales Office and Factory

Irvington
Varnish & Insulator Co.
Irvington, N. J.

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You can see all there is to see concerning radio, at our new show rooms, 227-229 Fulton Street, New York City. The official opening date is set for Saturday evening, April 22, 1922. A special feature of this official opening will be a dance, by radio music.

Complete Receiving Sets \$15.00 to \$300.00

We carry all the leading makes of apparatus, viz: RADIO CORPORATION, WESTERN ELECTRIC, GREBE, PARAGON, AMRAD, DORAN, ACME, MURDOCK, WESTINGHOUSE, BRANDES, FIRCO, FEDERAL, and GENERAL RADIO.

Largest Retail and Wholesale House of Radio Supplies in the East

Watch the next issue for full details of the new Western Electric Loud Speaker, including Two-Stage Power Amplifier.

When in town, visit our library, which includes technical books on both wireless and electricity, and all popular radio publications. Questions will be answered by experts who are fully acquainted with both electrical and wireless theory and practice.

Send 10c for Our Latest Illustrated Catalog

American Electro Technical Appliance Co.

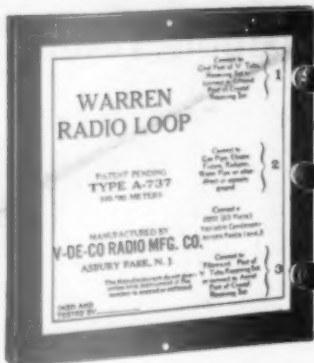
227-229-235 Fulton Street,

New York City

Warren Radio Loop

NO
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If Dad says—
"NO AERIAL ON THIS HOUSE"
don't allow his QRM to worry you but
purchase a

WARREN RADIO LOOP

The LOOP that made the Radio Roller Chair famous on the Boardwalk at Asbury Park, N. J. Is just the thing for an apartment or den. Is light in weight and easily portable. Is produced under a new principle of winding. Is wholly enclosed, thereby protecting the winding. Is used in place of an outside aerial. Is adapted for receiving in moving vehicles. Takes the "tic" from static. Eliminates all danger from lightning. Can be used with any receiving instrument. Can be used without tuner.



This picture of the Radio Roller Chair showing the Warren Radio LOOP was used as cover designs on "Wireless Age" and "Radio News" and featured in many other magazine and newspapers in the United States.

Send your order through your dealer or direct to us with his name.

Type-A-737 (300-700 meters)\$10.00
Type-A-7236 (175-1000 meters) 12.00

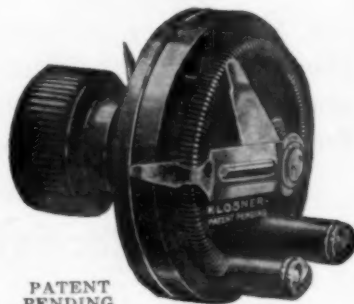
V-DE-CO RADIO MFG. CO.

DEPT. R, ASBURY PARK, N. J.

Send for bulletin—No. AIOI

MAKE NO MISTAKE

THE KLOSNER VERNIER RHEOSTAT



PATENT
PENDING

is the only Vernier Rheostat made
having the exclusive feature of using
but

ONE SINGLE KNOB

for both rough and fine adjustments. This feature allows the symmetrical appearance of the single knob to be retained when mounted on a panel with other instruments, and, at the same time adds to the simplicity and ease of operation in obtaining the necessary fine adjustments for best results from the modern critical vacuum tubes, especially when receiving phone and C.W. signals.

We invite comparison with any other filament rheostat now made. Look for the name KLOSNER moulded on the base.

Your dealer has them or send direct to us.

PRICE \$1.50

Shipping weight, One pound.
A two cent stamp brings interesting literature.

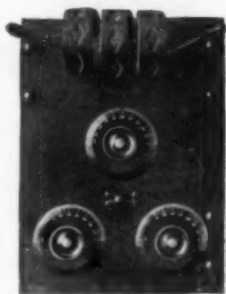
Made only by the Originators.

The Klosner Improved Apparatus Company

Dept. Q4

2024 Boston Road, New York City
N. Y.

Type "Q" Receiver



**AN IDEAL RECEIVING SET FOR LONG
AND SHORT WAVE AND RADIO
TELEPHONE RECEPTION**

This set is the most flexible receiving set on the market. With the use of the various sizes of Honeycomb Coils everything in the range of radio telegraph and telephone reception from 200 to 25,000 meters is brought into your home. Consists of a three coil mounting, and three Variable Condensers of proper capacity. Tuning extremely sharp. Remler dials.

Price without Detector.....\$35.00

Duck's New Radio Catalog No. 16



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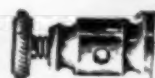
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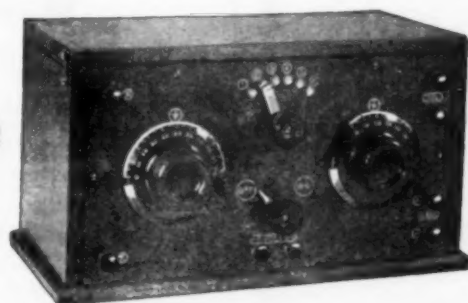
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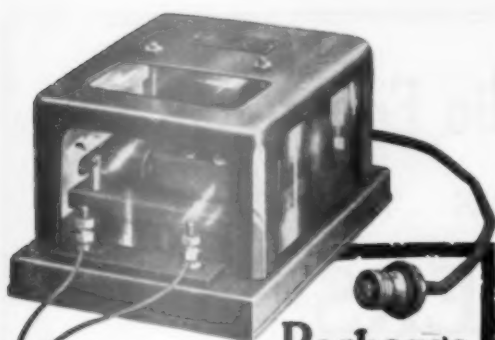
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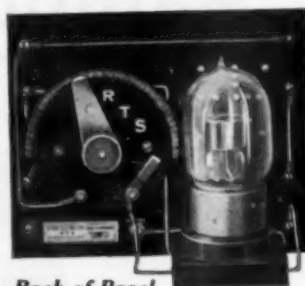
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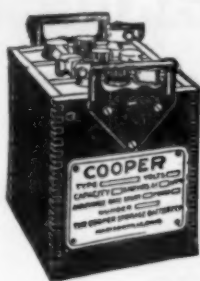
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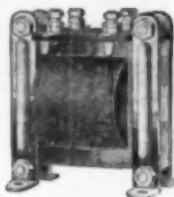
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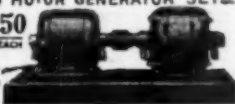
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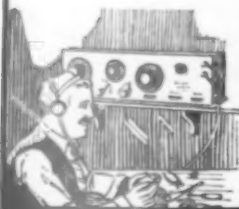
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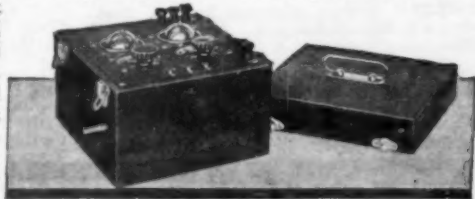
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The Radiohome Receiver

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The DT-800 Amplifier

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PATENTS ON RADIO—My special experience and compilation of patents and literature enables me to advise inventors and manufacturers on radio inventions and patents. John B. Brady, Ouray Building, Washington, D. C., formerly with Radio Division, Navy Department, and Secretary, Government Radio Board, investigating radio patent situation.

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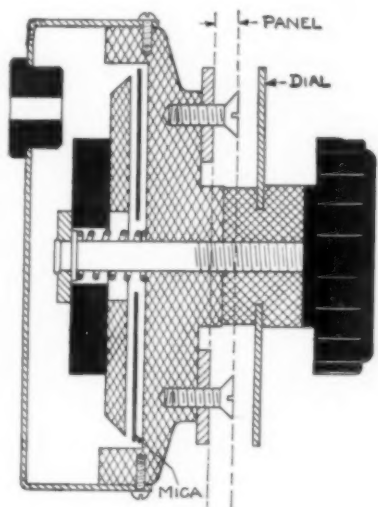
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